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HANDBOOK
OF THE
DESTRUCTIVE INSECTS
OF
VICTORIA.

PART V.

FRENCH.

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A HANDBOOK
OF THE
DESTRUCTIVE INSECTS
OF
VICTORIA,

WITH NOTES ON THE METHODS OF PREVENTION
AND EXTIRPATION.

Prepared by Order of the Victorian Department of Agriculture

BY

C. FRENCH, F.E.S.,

Government Entomologist.

PART V.

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W. H. LANGE

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PREFACE TO PART V.

In publishing Part V., the last but one of the *Destructive Insects of Victoria*, I may remark that some comparatively new insect pests have been included, especially the more formidable of those attacking orchards, crops, and forests.

As in Part IV., it will be noticed that some prominence has been given to insects attacking our forests. In America, India, and Germany, where forestry has been raised to a "fine art," and a huge commercial success, whole volumes dealing with forest pests have been published, and no expense spared in enlightening foresters and others similarly engaged. The Commonwealth of Australia is singularly rich in valuable timbers, the utilization of which is creating a great commercial industry. It is therefore advantageous that all possible information regarding forest insects should be widely disseminated.

As I have endeavoured to avoid technical names and terms as much as possible, it has been necessary to invent common names for many of the insects described. Fortunately, but very few additional orchard pests have to be recorded since the publication of Part IV., but, as we do not know the time when more of the native insects may leave their natural food to attack orchards, it follows that the distribution of practical and reliable information regarding them is a matter of urgent necessity.

Some additional insect-destroying birds are also dealt with in the present volume. As these birds are absolutely indispensable to the welfare of the orchardist, farmer, and forester, it is to be hoped that, with the aid of the coloured plates, they may be readily distinguished from the fruit and grain-eating kinds.

Part VI., now in course of preparation, will deal also with beneficial insects, and will complete the series, which, when finished, should constitute a standard work for Australia on the subject of Economic Entomology and Ornithology.

Following the preface is a very interesting Report, kindly furnished by Mr. J. G. Turner, Senior Inspector of Fruit Exports and Imports, and embodying the Regulations now in operation. The Report and Regulations will be helpful to both growers and shippers. At the end of the volume will be found a short summary of the latest spraying machines and materials placed on the market.

In conclusion, I have to thank the Assistant Entomologist, Mr. C. French, jun., for the many interesting field notes and observations ; Mr. A. T. Sharp, for reading the work, both in manuscript and in proof ; and Mr. H. Shelton for his assistance in the preparation of the Index.

CHAS. FRENCH.

Melbourne, December, 1910.

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REPORT OF THE SENIOR INSPECTOR, FRUIT EXPORTS AND IMPORTS

(MR. J. G. TURNER).

Melbourne, 1st December, 1910.

With regard to the Vegetation Diseases Acts, there have been no further amendments since the issue of Part IV., but suggestions have been forwarded to the Hon. the Minister, and certain alterations and additions which will tend towards more effective working are now under consideration.

The Regulations under this Act, on the other hand, have been revised, and considerable alteration has been made. In August, 1909, a Conference of State Ministers of Agriculture met in Melbourne to discuss the matter of restrictions on inter-State interchange of fruit, plants, &c. This was the second such Conference, the previous one having met in Sydney in February, 1908. It will be easily understood how such a course would tend to eliminate, to a great extent, the friction previously existing between the States.

Many important matters were dealt with at the last Conference, and the Regulations of this State have been amended to carry into effect the resolutions passed at same. The following is the form in which the General Regulations relating to the importation of nursery stock, trees, plants, and vegetables stand at present :—

REGULATIONS UNDER THE VEGETATION DISEASES ACTS.

UNDER the powers in that behalf conferred by the Vegetation Diseases Acts to make Regulations among others for the purpose of regulating importation, introduction, and bringing into Victoria of any particular kind of tree, plant, or vegetable likely, in the opinion of the Governor in Council, to spread any disease or insect, and for prescribing penalties for the breach of any Regulation so made, the Governor of the State of Victoria, by and with the advice of the Executive Council, doth order as follows :—

GENERAL.

1. The Regulations of the 13th day of May, 1908, and published in the *Government Gazette* of the 20th day of May, 1908, shall be, and the same are hereby repealed.

INTERPRETATION.

For the purpose of these Regulations, "Registered mark or brand" means any mark registered with and approved by the Department of Agriculture of the State of exportation.

IMPORTATION OF NURSERY STOCK, TREES, PLANTS, AND VEGETABLES GENERALLY.

2. All importers of nursery stock, trees, plants, or vegetables, the importation, introduction, or bringing into Victoria of which is for the time being prohibited, except subject to Regulations, not being of a kind in respect to which any other specific Regulation or Regulations is or are for the time being in force, must give notice to the Inspector under the Vegetation Diseases Act upon arrival of any nursery stock, trees, plants, or vegetables before the removal of such nursery stock, trees, plants, or vegetables from any dock, pier, wharf, station, or warehouse, where such nursery stock, trees, plants, or vegetables have been landed.

3. No person shall remove any nursery stock, trees, plants, or vegetables from any dock, pier, wharf, station, or warehouse unless and until such nursery stock, trees, plants, or vegetables shall have been examined and checked in an area, enclosure, or building approved by the Inspector, and a certificate or written permission for the removal shall have been obtained from the inspector.

IMPORTATION OF BANANAS.

4. No person shall land, or attempt to land, any bananas from any steam-ship or other vessel until each and every bunch shall have been examined by an inspector, and all diseased stalks or portions of stalks, diseased bananas, or bananas suspected to contain disease or insects, shall have been removed from such bunches.

5. No person shall land on any dock, pier, wharf, or any place whatsoever in Victoria any diseased stalks or portions of stalks, diseased bananas, or bananas suspected to contain disease or insects, and such diseased stalks or portions of stalks, diseased bananas, or bananas suspected to contain disease or insects, shall be destroyed as the inspector may direct.

6. No person shall remove any bananas which have been permitted landing from any importing vessel until such have been further examined in an area, enclosure, or building approved by the inspector.

7. No person shall remove any bananas or portions of such bananas from any dock, pier, wharf, or any place whatsoever whereon bananas are awaiting certification, unless and until written permission so to do shall have been obtained from the inspector.

8. No person shall discharge bananas from any vessel during the hours of darkness, except under special permit from the Minister of Agriculture.

IMPORTATION OF CITRUS FRUITS.

9. All importers of the fruit or any part of any tree of the citrus family must give notice to the inspector under the Vegetation Diseases Act, upon the arrival of the fruit, or any part of any tree of the citrus family, before the removal of such fruit or any part of any tree of the citrus family from any dock, pier, wharf, station, or warehouse where such fruit or any part of any tree of the citrus family shall have been landed.

10. No person shall remove the fruit or any part of any tree of the citrus family from any dock, pier, wharf, station, or warehouse, unless and until such fruit or any part of any tree of the citrus family shall have been examined and checked in an area, enclosure, or building approved by the inspector, and a certificate or written permission for removal shall have been obtained from the inspector.

REPORT OF SENIOR INSPECTOR, FRUIT EXPORTS
AND IMPORTS.

9

IMPORTATION OF NURSERY STOCK, TREES, PLANTS, AND VEGETABLES FROM
OTHER STATES.

11. No nursery stock, trees, plants, or vegetables shall be imported, introduced, or brought into the State of Victoria from any State or territory of the Commonwealth of Australia unless—

- (a) they be accompanied by a certificate signed by an officer of the Department of Agriculture of the exporting State or territory, stating that such goods have been examined by him, found to be reasonably free from disease, and fit for export, and that the packages containing the said nursery stock, trees, plants, or vegetables are new;
- (b) the arrival of such nursery stock, trees, plants, or vegetables has been duly notified to the inspector at the port of entry, and such nursery stock, trees, plants, or vegetables have been submitted to him for inspection, and a certificate or written authority of removal obtained from him;
- (c) each case, crate, bag, or bundle or other package containing nursery stock, trees, plants, or vegetables, and each bunch of bananas has indelibly and legibly printed, marked, stencilled, or impressed upon it, or upon a label, ticket, or tag attached thereto, the grower's or exporter's name and address, or his registered mark or brand, in letters or figures of not less than one-half inch in length.

12. All nursery stock, trees, plants, or vegetables imported into Victoria from any other State or territory, if complying with the conditions set out in Regulation 11 (a) shall be accepted as far as possible as being in the state or condition described in the certificate therein required, but if an inspector sees fit, he may inspect such nursery stock, trees, plants, or vegetables on arrival, and may reject the same if found to be diseased. All such diseased nursery stock, trees, plants, or vegetables shall be dealt with in accordance with the Act and these Regulations at the expense of the importer.

13. No potatoes (*Solanum tuberosum*) or tomatoes (*Solanum lycopersicum*) shall be imported, introduced, or brought into Victoria from any other State or territory of the Commonwealth of Australia except under the following conditions:—

- (a) That the arrival of such potatoes or tomatoes has been duly notified to an inspector, and a written certificate or written authority of removal has been obtained from an inspector.
- (b) That they are accompanied by a certificate signed by an officer of the Department of Agriculture of the exporting State or territory, setting forth that they have been examined by him and found fit for export.
- (c) That they are packed in new bags or other new packages, branded with the name and address of the grower and the number of the district wherein they have been grown.
- (d) That a declaration, in writing, accompanying such potatoes or tomatoes that the grower has no knowledge of Irish Blight (*Phytophthora infestans*) being in his crop.
- (e) That they have been grown in an area certified clean by an officer of the Department of Agriculture of the exporting State or territory.
- (f) That all such potatoes or tomatoes have been inspected at the port of export, and are accompanied by a certificate, in the form of certificate, Schedule A, hereto, stating that the potatoes or tomatoes appear to be free from Irish Blight and other proclaimed diseases, and that they have not been in or carried through any district wherein Irish Blight is known to exist.
- (g) That all such potatoes or tomatoes aforesaid are forwarded through the Port of Melbourne or other such places as may be approved by the Minister of Agriculture for the State of Victoria.

All such potatoes or tomatoes aforesaid imported under the conditions aforesaid shall be again inspected in Melbourne, or other approved place of entry, by an inspector of the Victorian Department of Agriculture, and if found to be free from Irish Blight and other proclaimed diseases may be removed therefrom on payment of inspection fees as prescribed.

In the event of Irish Blight being found in any stage of development on any part of the consignment, the whole of such consignment shall be condemned by an inspector in Melbourne or other approved place of entry, and no part of such consignment shall be allowed to be removed from the wharf or other place of entry, but the whole consignment must be taken back to the port of shipment at the expense of the consignee.

IMPORTATION OF SLIGHTLY DISEASED FRUIT.

14. Fruit which is found, on inspection, to be slightly diseased may be imported into Victoria from any other State or territory of the Commonwealth of Australia for manufacturing purposes only by *bonâ fide* fruit preservers upon the following conditions, viz. :—

- (a) Such fruit shall be inspected by an inspector, and may be rejected.
- (b) If passed by the inspector, such fruit shall be taken forthwith to any fruit-preserving factory approved by the inspector in charge, and there manufactured; the refuse of all such fruit shall be absolutely destroyed in such manner as the inspector may direct; all receptacles in which such fruit has been carried shall forthwith be either destroyed by fire or otherwise treated at the factory, to destroy all fruit diseases to the satisfaction of an officer of the Department of Agriculture.
- (c) No such fruit shall be sold or distributed unless in a manufactured state.
- (d) The manufacturer shall enter into a bond, with two approved sureties in the sum of £100, to observe the foregoing conditions.

15. If it is found by the inspector that any case or cases of imported fruit which have been condemned contain a fair proportion of fruit which is sound and free from disease, and also some fruit which is but slightly diseased, the contents of such cases may be sorted at any approved place under the supervision of an inspector under the following conditions, viz. :—

- (a) Such case or cases with their contents shall be taken forthwith from the place of inspection to the approved place aforesaid.
- (b) When sorted, fruit which is free from disease may be repacked in clean cases and disposed of in the ordinary way, while slightly diseased fruit may be disposed of to the fruit preservers, when it shall be subject to all the conditions contained in Regulation 14 above mentioned.
- (c) All fruit which after sorting shall be deemed by the inspector to be unfit, by reason of disease, for either of the foregoing purposes, shall be destroyed at the importer's or consignee's expense.
- (d) A charge not exceeding Threepence per case or package shall be made to cover the cost of sorting.

PENALTIES.

16. Any person who shall be guilty of a breach of, or shall fail to comply with, these Regulations shall be liable to a penalty for the first offence not exceeding One pound, and for any subsequent offence not exceeding Ten pounds.

REPORT OF SENIOR INSPECTOR, FRUIT EXPORTS 11 AND IMPORTS.

SCHEDULE A.

DECLARATION AND CERTIFICATE TO ACCOMPANY SHIPMENTS OF POTATOES OR
TOMATOES FROM THE STATE OF TO THE STATE OF
VICTORIA.

I, , hereby declare that the undermentioned packages
consigned by to
per contain which were grown
at my farm at in the State of ,
and that no species of Irish Blight is known to exist in the crop from which they
were taken.

No. of bags Marks
The above have been consigned to
per for Melbourne.
Shipping Marks
Signature of Shipper

INSPECTOR'S CERTIFICATE.

I hereby certify that I have duly inspected the above-mentioned
and have found them to be, to the best of my knowledge, clean and free from
Irish Blight in any stage of development, and from any other disease proclaimed
in the State of Victoria.

These have been grown in an area free from Irish Blight
and have not been in or carried through any area wherein that disease is known
to exist.

Dated at this day of 19
Signature of Officer of Department of Agriculture.
Official Designation
Address

Considerable fear for the safety of the potato industry was awakened
towards the close of last year by the discovery of outbreaks of Irish
Blight in this and other States. Vigorous steps are being taken by all
the States in this matter. The local transfer of potatoes is under
strict supervision, and, as will be seen, ample provision has been
made in the Regulations to prevent the disease being introduced in
imports from other States.

The Regulations fixing the fees to be charged for inspection, &c.,
have been altered from time to time. Additions have also been made
to the list of diseases given on pages 24-5 of Part IV. These are as
follows:—

Scientific Name.		INSECTS.		Common Name.
Anguillulidæ	Eel-worms.	
Anthomyiidæ	Flies of the onion, cabbage, cauliflower, &c.	
Aræocercus fasciculatus	Nutmeg Beetle.	
Bostrychidæ	Beetles.	
Cioidæ		
Scolytidæ		
Coccidæ	All scale insects.	
Cylas formicarius	Sweet-potato Weevil.	

FUNGI.

Scientific Name.		Common Name.
<i>Armillaria mellea</i>	..	Root rot.
<i>Claviceps purpurea</i>	..	Ergot.
<i>Peronospora</i>	..	Mildew and blight of leaves, twigs, and fruit.
<i>Tilletia levis</i>	..	} Stinking smut or ball smut of wheat.
<i>Tilletia tritici</i>	..	
<i>Ustilaginæ</i>	..	Smuts.
..	Potato scab.

The inspection of shops, markets, barrows, &c., under the provisions of the Vegetation Diseases Act, No. 1773, is still being vigorously carried forward, and its effect is to be seen in the improved quality of the fruit now being sold.

Many complaints have been received, from time to time, respecting the manner in which some salesmen defraud buyers by "topping up" their fruit. Seeds are also often mixed with inferior and cheaper varieties, or otherwise adulterated. The Hon. the Minister has been asked to take action to put a stop to these fraudulent practices. A short time ago he requested me to furnish him with drafts of Bills to deal with these matters. This has been done, and the new measures will shortly be placed before Parliament.

It was thought for some time that the Queensland banana industry was in danger of becoming extinct. The decline originated with the destruction of a large number of plantations by floods. Shortly after this occurred, the new Victorian Regulations were issued, and drastic treatment was meted out to all fruit showing evidence of Fruit Fly. The growers of bananas took alarm at the severity of these Regulations, and representation was made that a responsible officer of the Department should be sent to investigate the conditions under which the bananas were grown and shipped in Queensland, and also to allay the fears of growers regarding the supposed stringency of our Regulations. Advice was required, as well, regarding the stage of maturity at which bananas should be cut, and also many other matters pertaining to shipment to this State. Under instructions from the Hon. the Minister, I left Melbourne on 6th September, 1909. I visited various plantations, met many growers, addressed numerous meetings, explained the requirements of our Regulations, and generally instructed those interested on all matters relating to the shipment of these fruits. Good results may shortly be expected from this visit. Already a great improvement is manifest in the size and quality of the bananas coming forward, and, as large additional areas are being planted, it is expected that there will also be a considerable increase in the quantities forwarded.

On 1st July, 1909, the Federal Quarantine Act came into operation, and a considerable portion of the work previously performed under the Vegetation Diseases Acts is now being carried out under the Federal measure. This law provides for the inspection and, if necessary, the quarantine and treatment of plants (among other things). So far, the operation of the Act has been confined to imports from countries outside the Commonwealth ; but power exists to extend same to local transfer if the necessity should arise.

The methods of examination, though somewhat more drastic from the wider scope of the Act, are, on the whole, similar to those which obtained under State law, and the work is still carried out by the officers of this Branch.

The measure, on the whole, has been found to work smoothly. As it has, however, been in operation for little over a year, it is somewhat early to venture an absolute opinion as to its ultimate efficiency as compared with the State measure ; but the fact that it operates uniformly throughout the whole Commonwealth is a substantial argument in its favour.

With respect to goods intended for export, those for other States must be accompanied by a certificate, stating that they have been examined and found free from disease. It is also necessary that all cases or other packages be new, and bear the name and address or the registered mark or brand of the grower or exporter in letters of not less than one half-inch in length.

The following are additional Special Regulations in force in other States :—

Queensland.—Vines and portions of vines are prohibited.

Tasmania.—Plants must be fumigated prior to shipment, and are only permitted to land at Hobart, Launceston, and Devonport.

South Australia.—Vines or portions of vines are prohibited entry. Plants or portions of plants must be accompanied by a declaration stating that they were grown at a greater distance than 50 yards of any grape vines, and that no *Phylloxera* exists or has existed in the nursery or garden in which the plants have been growing.

Western Australia.—Vines on arrival are grown in quarantine for one season. Albany and Fremantle are the only ports where plants may be landed.

The examination of fruit, plants, &c., intended for export to countries outside the Commonwealth is carried out under the provisions of the Federal Commerce Act and Regulations. This measure prohibits the export of such goods unless they bear a true description, setting out the following particulars :—

1. The kind of goods.
2. The net weight or quantity.
3. The name of the grower or exporter.
4. The name of the State wherein the goods were grown or produced.
5. The word "Australia."

A "Notice of Intention to Ship," and a "Request to Certify and Mark Goods with an Approved Stamp," must be lodged at this office at least 24 hours prior to the advertised time of departure of the exporting vessel. The goods are examined, and, if they are found to be in accordance with the requirements of the Act, they are stamped, and a certificate issued.

Some difficulty was experienced in efficiently dealing with trees, nursery stock, &c., under this measure. As these are usually shipped in bundles, which cannot be properly inspected unless taken to pieces, it has been arranged that nurserymen desirous of shipping such should first notify the Chief Inspector of Orchards, who will, if the nursery be found free from disease, issue a certificate to cover a period. After such certificate has been granted, the Senior Inspector of Plant Exports should be notified, in order that all necessary certificates for export may be obtained.

In connexion with the compilation of this report and the included Regulations, due credit must be given to Messrs. E. Meeking and A. F. Parker, the officers who have assisted me greatly during this busy period of the year.

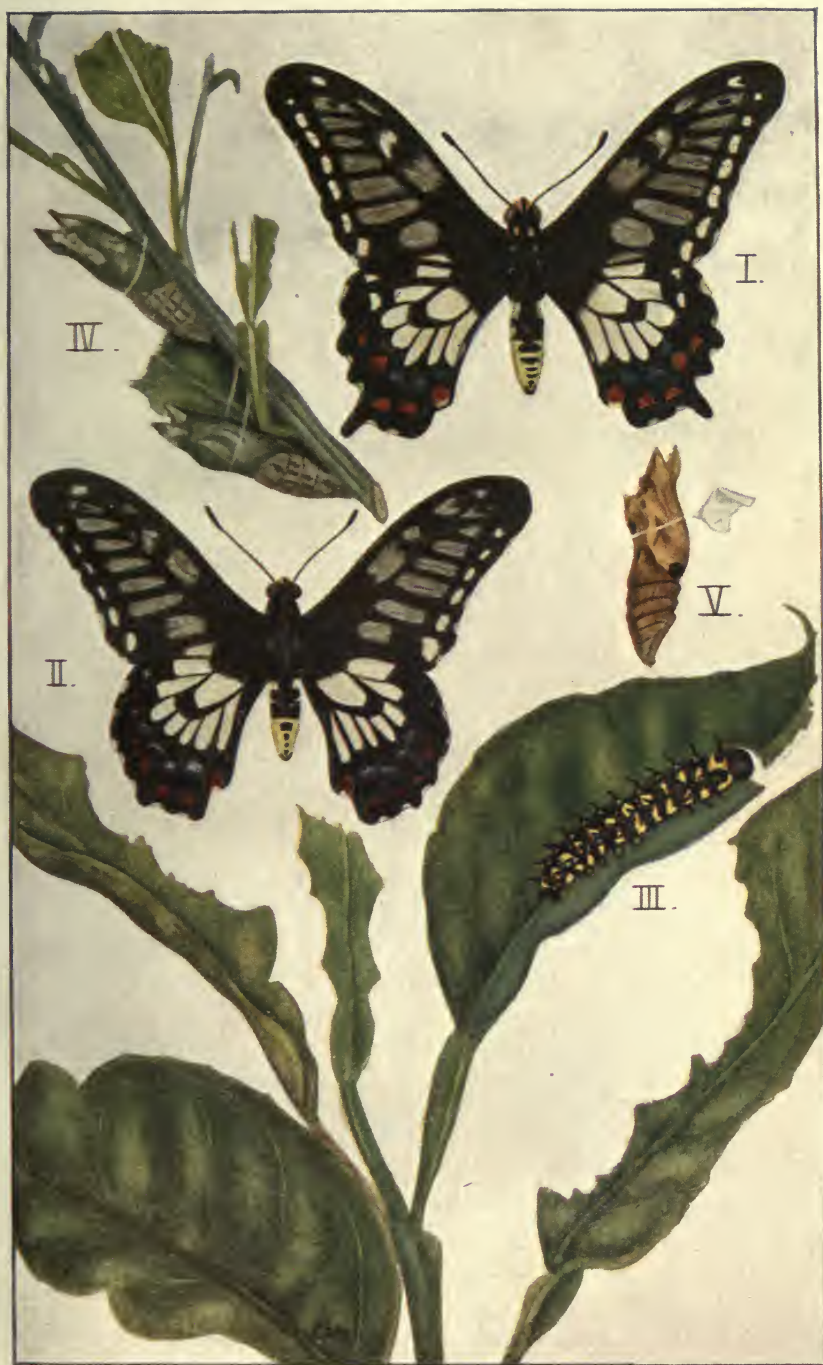


PLATE XCIX.

"BUTTERFLY OF THE ORANGE" (PAPILIO ANACTUS, MACLEAY).

Fig.

- I. Perfect Female. Natural size. From nature.
- II. Perfect Male. Natural size. From nature.
- III. Larva working on Orange leaf. Natural size. From nature.
- IV. Pupæ attached to Orange stem. Natural size. From nature.
- V. Pupæ, showing hole made by parasite. Natural size. From nature.



L. C. Vald. Andersen, Del.

C. French, Direxit.

Osboldstone & Co., Print.

Plate XCIX.

CHAPTER CVI.

BUTTERFLY OF THE ORANGE.

(*Papilio Anactus*, Macleay.)

Order: *Lepidoptera*. Family: *Papilionidæ*.

This is a handsome but very destructive caterpillar, whose favourite food plant would appear to be the foliage of Orange trees. The late Hon. William Macleay first described the insect, giving particulars as to its life history, &c.:—"A cylindrical caterpillar, slightly tapering towards each end (see Fig. III.), reaching a length of $1\frac{1}{2}$ inches; on the back are two rows of spines extending the whole length of the body, each segment bearing two. The third and fourth segment each bear an additional smaller spine below the former one. The colour of the segments is blackish-brown, with a few small yellow spots between them and at the side; a large infero lateral yellow spot on the fifth and on each of the segments posterior to it. The external aspect of the abdominal prolegs and a spot at the base of each thoracic leg are also yellow. The fork-like tentacle on the neck is orange-yellow. (As the larva is somewhat difficult to figure correctly, the above description is given to enable any one to recognise it should it appear upon their citrus trees.) The chrysalides (see Fig. IV.) are of a dirty white, with greenish blotches. The chrysalis is attached by its tail end, and is held in position by a loop of silk-like material surrounding the body at the junction of the thorax and abdomen."

The perfect insect is not likely to be mistaken for any other Victorian butterfly; the female, as usual in butterflies, is larger than the male. The eggs are deposited here and there upon the leaves of the orange, and, although small, are readily detected by the naked eye. The grubs are very voracious, and a few of these will strip a fair-sized plant of its foliage in a very short space of time. Anderson and Spry state that the larval stage lasts about a month, and the chrysalis only ten days.

How this insect got here from New South Wales is not difficult to conjecture ; I feel certain that the pupæ were introduced on young orange trees, the trade in which is very large and important. I am indebted to Mr. A. F. Thiele, the well-known Doncaster orchardist, for having first brought this insect under notice when found attacking orange trees in his district. With the extension of orange growing in this State, it is not unlikely that other of the New South Wales and Queensland pests may be introduced, so that a careful inspection of all young citrus trees coming should be made at the port of shipment and on arrival in Victoria.

Prevention and Remedies.

Fortunately for our growers, this beautiful butterfly is not common in Victoria, and an occasional look over the foliage is about the best preventive, as the caterpillars are easily seen, and can be destroyed. The perfect insect, as our plate shows, is conspicuous, and may be caught by means of a roughly-made net, so as to prevent egg-laying. Should the caterpillars be plentiful, hand-picking would, of course, be out of the question, but an occasional spraying with arsenate of lead or Paris green would suffice for the purpose ; 1 lb. of the latter, and 4 lbs. of lime to 180 gallons of water for orange foliage.

The pupæ of this butterfly appear liable to the attack of insect parasites. Fig. V. shows a pupa with hole on side. Mr. H. Tryon remarks that an hemipterous insect belonging to the family *Halydidæ* has been observed by him to attack the caterpillars of this butterfly as they fed on a young plant. It inserted its rostrum or beak into the flesh of the caterpillar, and then sucked its body juices. Mr. Tryon also speaks of having bred large dipterous insects belonging to the genus *Tachinus* from caterpillars of *Papilio erectheus*, called by Anderson and Spry the Orchard Swallow Tail. This latter butterfly is rare in Victoria, but common in New South Wales and Queensland, where it is a bad enemy of the orange grower. There is a third species of *Papilio*

which is rarely found in Victoria, although it has a wide geographical range; it is a tropical species, and closely allied to the Indian *P. erithronus*.

A small bird, *Zosterops coerulescens*, or White Eye, is said to be a great destroyer of these caterpillars; but, as these birds are great pests of the fruit-grower, I cannot advocate their protection. In Victoria, Tachinid Flies are not uncommon, so we can look upon them as useful helps in the orchard.

PLATE C.

“ METALLIC TOMATO FLY ” (*LONCHÆA SPLENDIDA*).

Fig.

- I. Tomato fruit, showing grubs at work. From nature.
- II. Perfect Insect. Enlarged. From nature.
- III. Pupa. Enlarged. From nature.
- IV. Larva. Enlarged. From nature.
- V. Perfect Insects. Natural size. From nature.
- VI. Larva. Natural size. From nature.
- VII. Pupa. Natural size. From nature.



L. C. Vald. Andersen, Del.

C. French, Direxit.

Osboldstone & Co., Print.

Plate C.

CHAPTER CVII.

METALLIC TOMATO FLY.

*(Lonchæa splendida.)*Order : *Diptera*. Family : *Trypetidæ*.

This pest is a very handsome fly, belonging to the real "Fruit Flies." It is of a metallic bluish-green in colour, and less than half the size of the common house fly. The body is tapered in shape, and the wings are of a smoky-pink colour, which speedily fades after death—a colour difficult to reproduce in a drawing. The larva is not unlike that of some of the ordinary fruit flies, but smaller and very active. Major Broun, F.E.S., of New Zealand, describes the body of this insect as glossy, dark bronze-green, head and legs black, basal joint tarsi, testaceous. The eyes of this insect are very large and prominent, the body being somewhat short and plump for the size of the insect.

This insect, so far as can be ascertained, is an importation from New South Wales ; at least, it was first observed here in tomatoes imported from that State. Mr. Froggatt speaks of *Lonchæa* being found in New Zealand and in the Pacific Islands, and it would now seem to have spread to most parts of Australia.

It has been stated that this fly will only attack fruits, &c., when the latter are either nearly ripe or have been bruised in some way. In Victoria, our experience is that it will tackle fruit, especially tomatoes, upon which no bruises or abrasions of any kind can be detected, even with the aid of a good lens. It is giving no end of trouble, and many cases which were thought to have been attributable to the Fruit Fly (*Halterophora capitata*), or the so-called Queensland Fruit Fly (*Dacus Tryoni*), have been traced to the depredations of this tiny insect.

Our plate shows the larva, pupa, and the perfect insect, both life size and magnified, and also the grubs at work in a tomato. Mr. Froggatt says that in New South Wales it infests decaying tomatoes, potatoes, egg-fruit, and other of the *Solanaceæ*. In Victoria, the chief trouble would appear to be in the tomato, and hundreds of acres have been ruined by this pest, and the fruit rendered absolutely unfit for use.

In speaking of a closely allied fly, *Drosophila*, Major Broun says—"This little cosmopolitan fly has become a great nuisance, especially during warm weather, when it attacks all sorts of fruit, more particularly bananas, oranges, and pineapples which have been bruised or begun to decay. If it confined its attention entirely to decaying fruit we might class it, along with many useful insects belonging to different orders, as a natural scavenger or sanitary agent, but it unfortunately also commits havoc with good fruit that has been cut. In order to test its habits more thoroughly, I left uncovered two Australian pineapples, out of which I had cut the maggots of the Queensland Fruit Fly (*Tephritis Tryoni*) in my office on the wharf last February. All decayed or infested portions were carefully cut away so that the exposed surface was perfectly good and sound. A few of these flies were in my office; they soon found the pines, and it is no exaggeration to state that within a fortnight hundreds of their maggots and chrysalids occupied the fruit, whilst the newly-emerged flies annoyed me so much when writing that I had to clear out the whole brood. Similar experiments with oranges and bananas need not be detailed, as the case of the pineapples show how prolific the fly is."

The genus *Drosophila* is well known to vigneron and fruit-growers, the former especially, as the tiny fly which infests the wine casks in the summer. My reason for giving the experiences of so capable an entomologist as Major Broun is to support the views which I have myself held regarding the Fruit Fly, which have been so frequently

contradicted, viz., that it will attack bananas. It is, therefore, necessary that we should carefully examine these fruits on their arrival in our State. It would be a difficult matter to place a limit on the numbers of different kinds of fruit that the fruit flies will attack, so that we cannot be too careful regarding imported fruit from Queensland and elsewhere.

It would be interesting to know, if possible, some of the details of the over-wintering of *Lonchæa* and insects of a somewhat similar kind. Many a time the larva of this fly in tomatoes has been mistaken for those of the genuine fruit fly, but we are glad to find that our determined stand when the Mediterranean Fly (*H. capitata*) made its appearance here, has led to the very best results.

Prevention and Remedies.

All tomato plantations should be kept free of weeds and rubbish of any kind. The land should be constantly stirred, and never allowed to become either too dry or too wet, so that the plants may be kept in full vigour. In small garden patches, fine mesh nets could be used, but on larger areas an occasional spraying with quassia chips as a preventive should be carefully and consistently given.

It is somewhat unfortunate for Victorian growers that the Chinese, although most successful vegetable gardeners, are indifferent to our recommendations, and, unless absolutely compelled, will rarely take the precautions necessary to protect their gardens or orchards from the inroads of this or other pests, and thus it happens that these are some of the principal breeding-places, both for insect pests and also for those of fungus origin.

When tomatoes, &c., are found to be affected with the grubs of this fly no time should be lost, and a gathering up of all infested fruits, tubers, &c., should be at once resorted to. These should be boiled, and fed to either pigs or fowls, but in no case should affected fruit, &c., be given

without having been boiled or well scalded, as the larvæ are not easily destroyed by ordinary methods. Should potatoes be affected, sprinkle occasionally when pitted with lime, turning the tubers over at the same time. This treatment will be beneficial in many ways, as it prevents "sprouting," and also the attacks of the larvæ of the Potato Moth (*Lita solanella*).

PLATE CI.

"DARK-STRIPED TIGER MOTH" (*DIACRISIA CANESCENS*, LE G.)

"LIGHT-STRIPED TIGER MOTH" (*ARTICES GLATIGNYI*, BUTLER).

Fig.

- I. Larva attacking cereals. Natural size. From nature.
- II. Pupa in grass. Natural size. From nature.
- III. Cocoon. Natural size. From nature.
- IV. Perfect Insect (Female). Natural size. From nature.
- V. Perfect Insect (Male). Natural size. From nature.
- VI. Perfect Insect. Natural size. From nature.



L. C. Vald. Andersen, Del.

C. French, Direxit.

Osboldstone & Co. Print.

Plate CI.

CHAPTER CVIII.

DARK-STRIPED TIGER MOTH.

(*Diacrisia canescens*, Le G.)

LIGHT-STRIPED TIGER MOTH.

(*Artices glatignyi*, Butler.)

Order : *Lepidoptera*. Family : *Arctiidae*.

These are two moths which, in the larval state, are very destructive to cereals and herbage of many kinds. Figs. IV. and V. on the plate are those of the Light-striped Tiger Moth (*A. glatignyi*), the larva of which feeds on the Native Hop (*Goodenia ovata*). This species is not so plentiful around Melbourne as is the other one shown on Fig. VI., but the larvæ sometimes occur in large numbers, and when hungry will tackle almost anything of a succulent nature. The male, as shown, is smaller than the female, and is somewhat lighter in colour. Both sexes remind one somewhat of the well-known Tiger Moth of English hedgerows. The larvæ or caterpillars of these moths are hairy, and frequently may be seen in large numbers. As a rule, birds do not seem to be partial to them.

The *Diacrisia canescens*, or Dark-striped Tiger Moth, is a very common and destructive insect. The larvæ do much damage to garden plants of all kinds, and especially to cereal crops. The eggs are deposited among weeds on neglected headlands, and when hatched the young feed ravenously. The cocoons are deposited near the base of the tussocks, and are partly covered with grass, as our plate shows. This species is much the more plentiful of the two, and does damage that other insects are credited with. The larvæ feed mostly by night, and hide by day.

Prevention and Remedies.

On cultivated areas, cleanliness is the main point in preventing attacks by insects of this class, as when grass or weeds are permitted to grow on headlands, these places are harbours for insects of all kinds. They are also covers for egg-laying, so that it will be seen that without clean cultivation the chances of escape from these pests will be considerably lessened. Trapping in places where stock is *not admitted* is about the best method of destroying the caterpillar. It is done by growing strips of such plants as appear to be most relished by the grubs, and spraying the same with either Paris green or arsenate of lead.

In some cases, fungus parasites especially prove valuable auxiliaries to the grower. Mr. E. Anderson, writing of the larva of a common Victorian moth (*Apina callisto*), says—“They are kept in check by a parasitic fungus, whose spores find a suitable germinating place in the bodies of the caterpillars, eventually choking up their whole system with a white corky substance, and, as the year is favourable to the abundance of the *Apina*, seem equally favourable to the spread of the fungus.” There is no doubt that fungus parasites help materially to keep certain of our insect pests in check, and it is a common occurrence well known to observers in the Victorian bush, to see dead grasshoppers in large quantities fastened on to the tops of rushes or other plants, and even on dead twigs. The bodies of these are found to be empty and shrivelled, but without any apparent cause, which, however, a powerful lens will at once disclose. It is also no uncommon sight to see caterpillars hanging limp and decomposed from twigs; the rapid action of the bacteria soon causes the death of the most robust caterpillars. The question of parasites as aids to destruction is as yet in its infancy, but the subject is a useful and interesting one, and should be closely studied, especially by those engaged in rural pursuits.



PLATES CII., CIII.

“COMMON THRIPS” (THRIPS TABACI, LINDEMANN).

PLATE CII.

Fig.

- I. Rose-bloom and buds deformed by Thrips. Natural size. From nature.
- II. Apple-bloom and buds deformed by Thrips. Natural size. From nature.
- III. Perfect Insect. Highly magnified. From nature.
- IV. Thrips on Rose. Natural size. From nature.

PLATE CIII.

Fig.

- IA. Perfect Insect. Magnified. From nature.
- IIA. Perfect Insect. Magnified. From nature.
- IIIA. Perfect Insect. Natural size. From nature.
- IVA. Larva. Natural size. From nature.
- V. Potato stem, with foliage dying. Natural size. From nature.

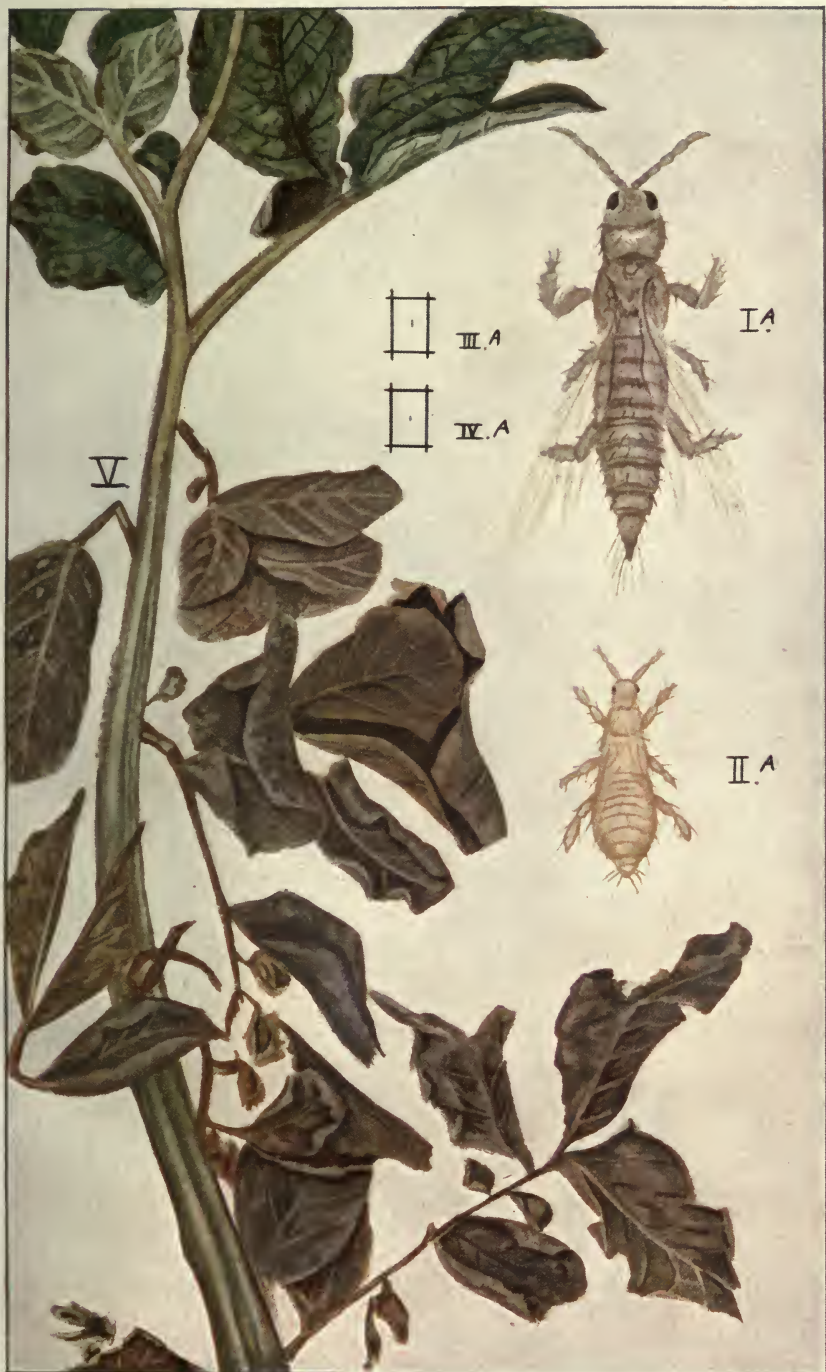


L. C. Vald. Andersen, Del.

C. French, Direxit

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Plate CII.



CHAPTER CIX.

COMMON THRIPS.

(*Thrips tabaci*, Lindemann.)

Order: *Thysanoptera*. Family: *Thripidæ*.

This is a singular little insect, characterized by long narrow membranous wings with long ciliæ or hairs, as shown in our enlarged figures. The pupa and perfect insects are very active, and almost too minute for a popular description; but when a plant or flower is badly affected, the whole appears to be covered with tiny, narrow, dark specks, which can hardly be determined with the naked eye. The species under notice is an introduction from Europe, and has long been known in England and elsewhere as one of the gardener's worst enemies, especially to plants growing under glass. The eggs are deposited on the food plant, which is, however, by no means limited to any particular kind.

Thrips are the greatest of all troubles to the rose-growers of this State, and appear in countless millions as if by magic. In Europe, an insect known as *Thrips cerealium* is a great pest of the wheat-grower, and in some instances has been known to do a vast amount of damage to the crops.

Other thrips, known as Gall-making Thrips, have been described by Mr. Froggatt. These singular bladder-like galls were found on the leaves of *Eugenias* and other ever-green plants. Our plate shows a rose bloom and bud absolutely deformed through the attacks of these tiny creatures. They are equally severe on apples and other blossoms, and frequently prevent the fruit setting.

In Russia, Dr. K. Lindemann, in his studies of these insects on the tobacco plant, found the life cycle to be as follows:—Development of egg, 10 days; development of

larva, 30 days ; development of nymph, 7 days ; total development, 47 days. In Florida, Professor Quaintance found it to be as follows :—Development of eggs, $3\frac{1}{2}$ to 4 days ; development of larva, 7 to 9 days ; development of nymph, 4 days ; total, $10\frac{1}{2}$ to 13 days. Experiments will be made by the Entomological Branch to ascertain, if possible, the difference in time of development as compared with the above results.

During the past few years, in Victoria, these troublesome insects have been very severe on potato crops in many parts of the State, and for the benefit of growers I have included the report of the Assistant Entomologist, Mr. French, jun., who, with Mr. G. Seymour, Potato Expert, has been conducting some important experiments in the Romsey and Lancefield district. He writes—“In company with Mr. Seymour, Potato Expert, I paid a visit to Romsey and Lancefield, and inspected the potato crops, and was surprised at the damage to them done by the thrips. Mr. Seymour estimates this season's loss at several thousand pounds at least. Last year the loss was about eight thousand pounds. The thrips are simply in millions, not only affecting potatoes, but also the pea crops, grasses, hawthorn and African box-thorn hedges, and, in fact, nearly every kind of plant. There is thus great difficulty in effectively dealing with the pest. The lower leaves of the potato plant are generally attacked first, and, after these are destroyed, the top ones are affected, and in a short time the whole plant shrivels up, and the potatoes are often only the size of a small marble. I may mention that on one pea leaf no less than 23 larvæ of the thrips were counted. This will give some idea of the enormous number of these insects.

Messrs. Robb Brothers very kindly placed part of their potato crop at our disposal for experiments, and I desire to tender them my best thanks for their assistance. Mr. Seymour procured the loan of a Strawsonizer spraying outfit from a firm in Melbourne. This was fixed up in a dray.

It worked very satisfactorily, the spray being forced up under the leaves, and other nozzles distributed the spray on the uppersides of the leaves, so that the plants were thoroughly soaked. The materials used were tobacco-water and benzine emulsion; the former with good results, but there is the drawback of having to strain it before use. If it is used in large quantities, it should be made in the winter and stored for use in the early summer, when the thrips make their appearance. The benzine emulsion, in the proportion of one in six, also proved very effective, every insect reached by this mixture being killed at once. This spray has the advantage also of being cheap. Messrs. Robb were well satisfied with the results of the latter mixture especially.

Owing to the potato crops being mostly damaged, it is useless to carry out any further experiments this season, but early next season I will continue the experiments, trying other mixtures in addition to those already used. Owing to this season being very dry, the thrip pest was very bad. Should next season be cooler, and the rainfall larger, the damage will be considerably mitigated. I am obliged to Mr. Seymour for the valuable assistance rendered in connexion with the experiments."

Prevention and Remedies.

Under glass, the thrips are not so difficult to deal with, but out-of-doors the task would appear to be almost an impossible one. In the early spring of 1909, these pests covered the Cape Weed when in flower, and extended over thousands of acres of Cape Weed-infested land. Whole paddocks appeared to be alive with them, so that it would be impossible to destroy them.

The best plan of dealing with the pest is to keep a constant watch, and spray regularly with some deterrent, such as quassia chips, and to destroy all affected blooms. The land should be kept well stirred, and the plants kept growing as freely as possible. In small gardens and in

the
p 12

glass houses, the old-fashioned, but wonderfully successful, Gishurst compound is to be highly recommended. Unfortunately, in roses, the tiny beasts get right into the centre of the blooms, thus rendering the task of successful spraying even with tobacco or kerosene exceedingly difficult. I have great hopes that suitable light canvas covers may be successfully used, as cyanide gas, if applied by an expert, would be the most effective way of dealing with them; where the most careful spraying would fail to come in contact with the insects, the gas would be almost instantaneous.

Various materials have been recommended for use as mulching, but where it is to be obtained grass hay is the cleanest and best, and is not likely to be scraped away by birds. Stable manure, although most useful and desirable, is a harbour for thrips, flies, and other insects, so that, in rose gardens at any rate, the use of crushed bones would be preferable. In trying to avoid the attacks of thrips, some growers have resorted to blood manure and other powerful soil stimulants, but with roses especially these must be used with some discretion.

In America, the favourite spray for thrips is whale-oil soap, one pound to each gallon of water used, and applied at a temperature of 130 degrees Fahr. According to the *California Fruit Grower*, the use of lime in the following proportions has been highly recommended:—35 lbs. of lime to 100 gallons of water. Where requisite, a stronger spray from 50 to 75 lbs. of lime to the 100 gallons of water, was used with the best results. In Victoria, we have had the best results with benzole soap, the preparation suggested by this Branch, and manufactured by Mr. S. Lowe, of Victoria-street, Abbotsford, under the name of "Benzole Emulsion."

The thrips question is even now a very serious one, as so large a number of plants are subject to its attacks, and no one knows where the trouble is going to end. It behoves all growers to look this trouble

square in the face, and, if possible, to keep it within reasonable bounds. Only a strict co-operation on the part of the growers, coupled with such advice as can be tendered, can hope to bring about the desired results. Where gardens or orchards are surrounded by Cape Weed or even *Hypocharis*-infested paddocks, the exclusion of thrips from the gardens would appear to be hopeless, and in such cases smoking out where practicable should be resorted to.

When the buds are just bursting is the time for an occasional spraying with a weak material, such as deterrents, but in the case of roses, when the thrips have once got into the buds, the latter may as well be cut off and burnt, as the blossoms are sure to be a failure. It is pitiful to see the devastation that these tiny beasts will sometimes cause in a rose garden; still, there are some roses which appear to be much less liable to attack than such kinds as those of the splendid Cochet type, so that future generations may see a hardier type of thrip-resisting roses.

In England, gardeners depend on a liberal use of syringing with water, but here, after a drenching storm of rain, the thrips are as bad as ever.

Professor Webster remarks that this pest is increasing rapidly in Ohio (U.S.A.), as extensive onion-growers have recently found out to their cost; it is a serious obstacle to successful onion culture, especially in dry summers. Onion-growers will therefore need to be on the look-out; if the pest be noticed, the fact should at once be reported to the Entomologist.

PLATE CIV.

“FIRE-BLIGHT OF THE WATTLE” (PAROPSIS ORPHANA, ERICHSON).

Fig.

1. Wattle branch, showing damage caused by larvæ. Natural size.
From nature.
2. Perfect Insect at rest and on wing. Natural size. From nature.
3. Pupa. Magnified. From nature.
4. Larvæ, upper and side view. Magnified. From nature.
5. Oil glands of larva. Magnified. From nature.
6. Foreleg of larva. Magnified. From nature.
7. Larvæ about to change to pupæ. Natural size. From nature.



C. C. Brittlebank, Del.

C. French, Direxit.

Osboldstone & Co., Print.

Plate CIV.

CHAPTER CX.

FIRE BLIGHT OF THE WATTLE.

(*Paropsis orphana*, Erichson.)

Order: *Coleoptera*. Family: *Chrysomelidæ*.

This is a small beetle belonging to the large group of leaf feeders. It is light-green in colour, with white stripes or markings. The eggs, which are somewhat spindle-shaped, are laid in clusters on the foliage and tender twigs of the plant. When hatched, the young larvæ spread out and crawl over the whole foliage, and, being in vast numbers, soon commence the work of destruction by eating into the epidermis of the leaves. The latter at once turn a reddish-brown in colour, and when seen from a distance the plantation appears as if a fire had gone through it, hence the common name "Fire Blight." The larvæ are stout, and of a dirty green colour, with two pale parallel lines running down the dorsal surface from behind the head to the tip of the abdomen; and, as they assimilate, both in colour and shape, to the twigs and foliage among which they are feeding, they may easily escape notice by the casual observer.

Of all the insect enemies of the wattle industry, this beetle is by far the worst; and, as the insects are in such enormous numbers, it is almost impossible to deal successfully with them. I made the first investigation of the life history and habits of this terrible pest. We know that it has a wide geographical range in our State, and is also found in New South Wales and Tasmania. In Victoria, my experience has been that the only plants attacked to any extent are the common Black Wattle (*Acacia decurrens*) and the Silver Wattle (*A. dealbata*). Although I have repeatedly looked for it, I have never yet seen

it on either the Golden Wattle (*A. pycnantha*) or on any other of the more arborescent, or others of the wattle "family." When I say that I have not found this beetle on any other plants other than the two wattles before mentioned, I mean that I have not seen it in any harmful numbers—an odd beetle or so will when flying alight almost anywhere. As an example of their numbers, I may say that I have shaken off as many as 600 beetles from one small wattle.

When the larvæ are full grown (in Victoria from about July to January), they descend into the soil, the grubs being at this time of a much lighter green—almost yellow in colour. When in the soil, usually from 1 to 4 yards from the stem of the tree, and about 2 inches below the surface, they remain until assuming the pupal stage, and, upon emerging from the soil as perfect beetles, climb up the stem of the tree. Here their wing-cases harden, and the function of reproduction at once commences. From my own observations, which have been extensive, I judge that the birds are not partial to the grubs of this beetle, as both larvæ and beetles may be seen crawling up and down the stem quite unmolested, either by birds or ants.

According to what I have both heard and seen, the stripping of the foliage in such a wholesale manner renders the bark very difficult of removal, and results, owing to constant attacks, in the death of the affected tree. Many trees so attacked will manage to temporarily recover, the principal effect being that the tree becomes what is generally known as "hide-bound." Thus the bark is more difficult to strip, and even when stripped has lost much of its tannic value.

It appears very singular that a tree so astringent in its nature should furnish such a palatable food for this pest, although it is well known that some beetles will live upon capsicums, cigars, and on the turpentine-impregnated *Coniferæ*, such as White Deal, &c. According to my own experience, the beautiful Silver Wattle is mainly responsible

as a food plant for carrying these beetles over the winter, thus keeping them going until the black wattles are sufficiently large to be attacked.

Prevention and Remedies.

On small areas, such as public parks and gardens, the beetles may be kept off by spraying with some deterrent such as kerosene emulsion or an infusion of quassia chips, but the former-mentioned material, taking into consideration its volatile nature, coupled with the intermittent period of egg-laying, should be frequently renewed. The surest plan of getting rid of these pests is to destroy as many of the perfect insects as possible. This may be done by beating the trees with long poles, and by covering the surface of the ground beneath the tree with lime. I have found, by personal experience, that on small areas of land so treated neither larvæ nor pupæ will come to maturity.

As showing the enormous damage done by this insignificant beetle, I may mention the fact of the late Mr. Michaelis, then a well-known merchant of Melbourne, having expended between £30,000 and £40,000 in his endeavour to place the production of wattle bark in its proper place as one of the chief industries of the State. The wattle plantations referred to were planted in the Gippsland Lakes district, and just as things looked flourishing for the spirited owner, the "Fire Blight" made its appearance, and, notwithstanding all efforts and experiments, in which I gladly assisted, a hopeful commencement was changed into a huge failure. In this case no expense was spared; spraying, shiploads of lime, beating, and other means were tried, but the beetles came on in such vast numbers as to baffle all attempts to cope with them.

PLATE CV.

“ TOMATO WEEVIL ” (*DESIANTHA NOCIVA*, LEA).

Fig.

- I. Perfect Beetle. Natural size. From nature.
- II. Perfect Beetle (side view). Natural size. From nature.
- III. Perfect Beetle. Magnified. From nature.
- IV. Perfect Beetle (side view). Magnified. From nature.
- V. Larva. Magnified. From nature.
- VI. Larva (side view). Magnified. From nature.
- VII. Larva (side view). Natural size. From nature.
- VIII. Larva. Natural size. From nature.
- IX. Pupa. Magnified. From nature.
- X. Pupa in cocoon. Natural size. From nature.
- XI. Pupa case. Natural size. From nature.



IV



I



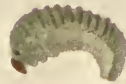
III



II



V



VI



VIII



IX



VII



X



XI

CHAPTER CXI.

TOMATO WEEVIL.

(*Desiantha nociva*, Lea.)

Order : *Coleoptera*. Family : *Curculionidæ*.

This pest is a small beetle about a quarter of an inch in length, with a somewhat V-shaped marking on the wing-cases. The whole appearance of the insect is greyish-brown in colour. The larva or caterpillar is small, of a pea-green colour, and is usually found in the soil a few inches below the surface. When about to pupate, or to change into the chrysalis stage, it constructs a cocoon made of soil (see Figs. X.-XI.), where it remains for a couple of months, and emerges as the perfect beetle.

This is a new and formidable enemy of the tomato-grower, and was first brought under notice by the Assistant Entomologist, Mr. C. French, jun., who sent the specimens, as being new to him, to Mr. Lea, F.E.S., State Entomologist, Tasmania, who is a specialist in the *Curculionidæ*, or Weevils. The family *Curculionidæ* embraces several thousand species in Australia alone. Mr. Lea found the specimen to be new to science, and has named it as above. The beetle itself is nearly as destructive as the larva, and goes down into the soil in the daytime, coming up at night to feed. The larvæ often feed in the daytime, but the perfect insect rarely does so. The genus *Desiantha* is a fairly large one, and comprises many destructive kinds, some of which gnaw the buds of plum and other fruit trees, frequently destroying a large portion of the crop.

Mr. C. French, jun., in an article contributed to the *Victorian Journal of Agriculture*, says—"During the last three months, many specimens of this beetle and its larvæ were sent to the Entomological Branch, the persons forwarding them stating that these weevils were destroying

large numbers of tomatoes and other plants at Ascot Vale, Essendon, Preston, and other places near Melbourne. These insects are simply in thousands in some gardens, and destroy nearly all kinds of vegetables. One grower informs me that he lost 80 fine tomato plants in one night, and that on one evening alone he collected no less than 638 of the beetles in the course of an hour, and in a week he estimates he captured and destroyed some thousands. The insects conceal themselves in the soil and *debris* in the daytime, and at night come out to feed. They devour the whole plant very rapidly, and, should they be disturbed or a light be brought near them, they immediately drop to the ground, and get out of sight as soon as possible."

It is very remarkable that this weevil, although in such large numbers, has hitherto been unrecorded, but it is one of those entomological enigmas which are frequently making themselves manifest; hence the great value of the study of economic entomology.

Prevention and Remedies.

Some tomatoes sprayed with arsenate of lead were placed in an observation box by Mr. C. French, jun., and 50 of the beetles were liberated and turned adrift into the box. They at once commenced to feed, with the result that they were all dead within 24 hours. As the weevils are in the ground close to the plant during the day, I would advise that the soil be continually turned up, and that fowls be placed in the coops close to the plants.

Another good plan would be to hold an expanded umbrella under the plants, giving them a sharp jar or shake, thereby catching the beetles in thousands. They can then be destroyed by burning or scalding. Many of this family of weevils are very tenacious of life, so the water must be boiling or as near to it as possible. Trap crops of anything palatable to the insects should be planted near to the tomatoes, and sprayed with arsenate

of lead or Paris green, and by this means large numbers of beetles and larvæ will be killed. Another good plan, which has been effectually tested, is the placing of pieces of newspaper under the plants at night, and for the grower to go out at intervals with a light; the beetles, startled by the light, immediately fall into the paper, and may then be destroyed. These weevils are very partial to the Marsh Mallow, and this otherwise noxious weed might be turned to good account by poisoning the leaves as before stated.

The tomato weevil is a prolific breeder, and every possible means should be adopted to prevent its spread. It may be seen throughout the year, and the damage must necessarily be considerable. Growers are warned against spraying with the arsenical preparations such crops as tomatoes, lettuce, cabbage, &c., as vegetables are frequently consumed before being washed thoroughly. In such cases, a weak solution of quassia chips or kerosene emulsion as a deterrent is to be preferred.

PLATE CVI.

"LARGE DIADOXUS BORER" (DIADOXUS SCALARIS, LAP. ET GORY).

Fig.

- I. Branch of *Cupressus Lambertiana*, with larva. Natural size.
From nature.
- II. Perfect Insect (Male). Natural size. From nature.
- III. Perfect Insect (on wing). Natural size. From nature.
- IIIA. Perfect Insect (Female). Natural size. From nature.
- IV. Head of Perfect Insect. Magnified. From nature.



C. C. Brittlebank, Del.

C. French, Direxit.

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Plate CVI.

CHAPTER CXII.

LARGE DIADOXUS BORER.

(*Diadoxus scalaris*, Lap. et Gory.)

Order : *Coleoptera*. Family : *Buprestidæ*.

The genus *Diadoxus*, which comprises three species, was formerly known to Victorian entomologists as belonging to the foreign genus *Ancylocheiria*. There are but two Victorian species, the one under notice here being much the larger of the two ; the larvæ of both live in the wood of the Murray pine, and are terribly destructive, also to the Lambert's Cypress (*Cupressus Lambertiana*), the latter being the plant so largely in use for hedges and breakwinds.

The males (see Figs. II. and III.) are smaller than the females, and, as a rule, display greater activity. In small trees the larvæ of these insects first feed round the stem under the bark, cutting the sap wood, and causing the tree to snap off. When the Cypress is attacked, the boring is the same as that shown on the plate. The perfect insect, then somewhat soft, emerges from the holes in the side of the tree attacked. The larva is flattened in shape, with the head and thorax part much dilated. A little warmth soon serves to harden the newly-emerged beetles, which soon become very quick in their movements, especially when walking. The mandibles of the larvæ are strong, and well adapted for tunnelling.

It has been stated that the Murray Pine is almost immune from insect attacks. Leaving these two beetles out of the question, there are others which are almost peculiar to the Murray Pine timber. When cut, however, it is one of the very few timbers which the White Ant seems not to be particularly fond of, although it is by no means exempt from the latter pest.

Prevention and Remedies.

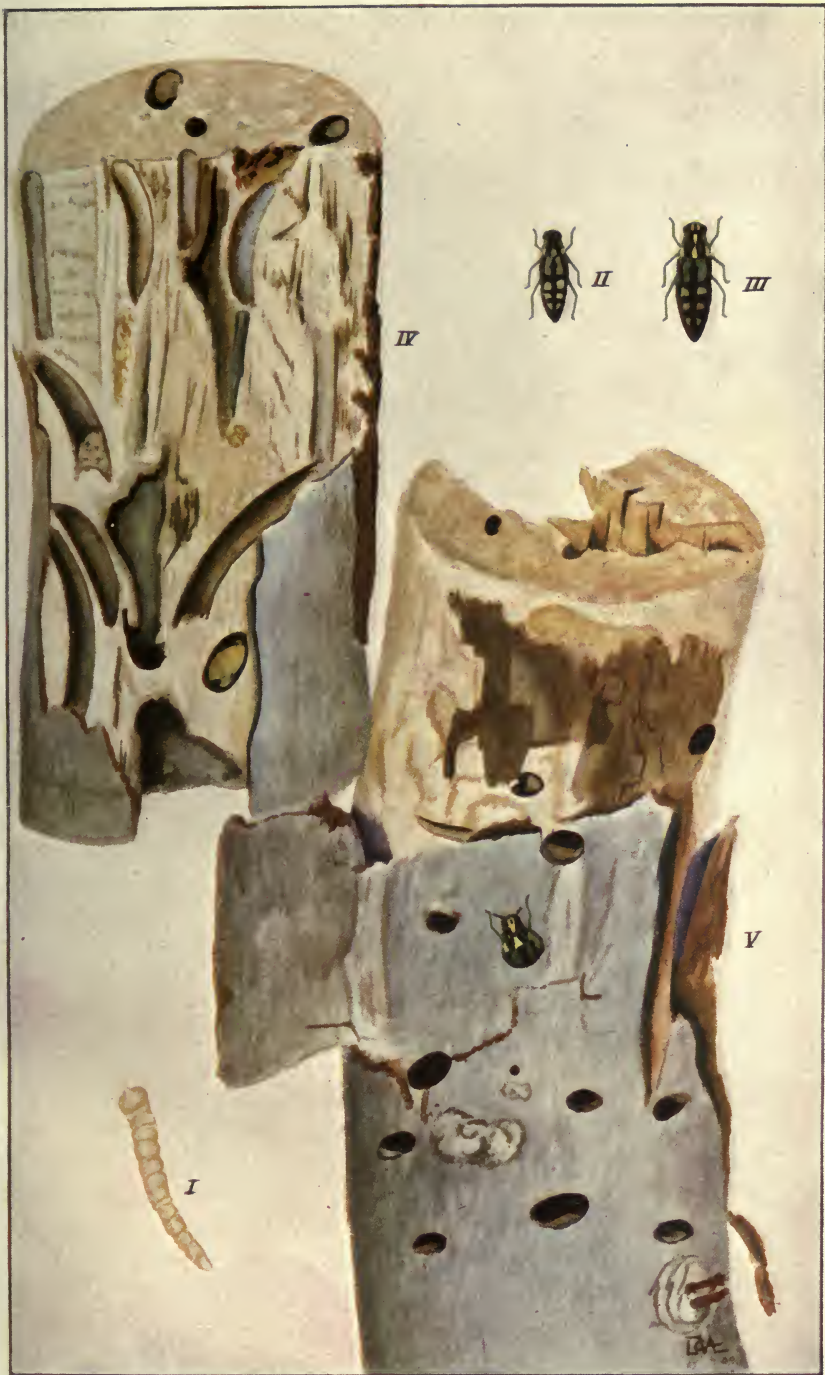
In dealing with matters of this kind, one cannot but recommend a constant vigilance, particularly if the plants are situated in or near Murray Pine country. Should the upper branches, especially, show traces of turning yellow, the trees should be at once examined ; if carefully looked at, tiny holes may be seen, and probably the beetles may be emerging, as shown on the plate (Fig. I.). In such a case, the holes should be probed with wire dipped in bi-sulphide of carbon, leaving the wire in the holes. This could be done by a boy, and would be effective.

PLATE CVII.

“SMALL DIADOXUS BORER” (*DIADOXUS ERYTHRURUS*, WHITE).

Fig.

- I. Larva of Beetle. Enlarged. From nature.
- II. Perfect Insect (Male). Natural size. From nature.
- III. Perfect Insect (Female). Natural size. From nature.
- IV. Portion of Cypress, bored by larvæ. From nature.
- V. Portion of Cypress, showing Perfect Insect escaping from wood.
From nature.



CHAPTER CXIII.

SMALL DIADOXUS BORER.

*(Diadoxus erythrurus, White.)*Order: *Coleoptera*. Family: *Buprestidæ*.

This is a pretty but very destructive beetle, whose natural home is in the Murray Pine (*Frenela*). It is much more common than the large species (*D. scalaris*), and appears to be more widely distributed. It is by no means certain that either of these is confined strictly to the *Coniferæ*, both species having been taken where neither the pine nor the cypress grows; I strongly suspect the Mulga and other of the stunted forms of *Acacias* to be the hosts of these and other boring beetles.

The eggs of this species are deposited in crevices of the bark, and as soon as they are hatched the grubs commence boring their way into the tree. When the full size is attained, they are supposed to remain in the wood for some considerable time, they then change into the pupal stage, and so remain until the final change into the perfect beetle. The larva or grub is yellowish-white in colour, and about half the size of that illustrated.

It is singular that when alive these beetles are greenish in colour, and after death they turn yellow.

This beetle is found also in New South Wales, South, and Western Australia.

Generally speaking, the *Diadoxus* may be termed dry country beetles, and, although both of the Victorian kinds have frequently been found crawling in the streets of Melbourne and suburbs, they are much more plentiful in the Mallee districts. These beetles are largely responsible for the disappearance of many fine ornamental trees from our streets. Many years ago, the *Lambertianas* about Melbourne were dying out in patches, and the late Mr. Elliott,

of the *Age* staff, and myself, set to work to try and find out the cause. We were successful ; from one large *Cupressus* we took no less than 37 beetles, besides numbers of larvæ and pupæ, thus accounting for the trouble.

Apart from the fact that Lambert's Cypress is the best hedge plant in the State, it is discouraging to find that, in spite of, perhaps, years of careful attention in treating the plants, large gaps of dying plants are seen. These never regain their former condition, even if attended to promptly.

Fig. V. gives a fair idea of the damage caused by these insects.

Lately, it was rumoured that the beetle had attacked apple trees, but inquiries elicited the fact that a mistake had been made, and for this we are grateful. One thing is certain : These insects are never to be depended upon, and care should be taken that they do not, like many other pests, attack the fruit trees in this State. It is desirable to know as much as possible of the habits of these beetles, so as to save much time and useless experiments.

Prevention and Remedies.

The treatment is practically the same as that prescribed for the larger *Diadoxus* ; the principal difference is that where the insects are very bad, affected portions of the trees should, where practicable, be taken away and burnt. Isolated plants should be sprayed with kerosene and other deterrents, but on large areas this would, of course, be out of the question.

ORIGINAL ARTICLES

1. The Effect of the Diet on the Metabolism of the Human Body

2. The Effect of the Diet on the Metabolism of the Human Body

3. The Effect of the Diet on the Metabolism of the Human Body

4. The Effect of the Diet on the Metabolism of the Human Body

5. The Effect of the Diet on the Metabolism of the Human Body

6. The Effect of the Diet on the Metabolism of the Human Body

7. The Effect of the Diet on the Metabolism of the Human Body

8. The Effect of the Diet on the Metabolism of the Human Body

9. The Effect of the Diet on the Metabolism of the Human Body

10. The Effect of the Diet on the Metabolism of the Human Body

PLATE CVIII.

“ROSE AND RASPBERRY SCALE” (*DIASPIS ROSÆ*, SANDBERG).

Fig.

- I. Scales on Rose Twig. Natural size. From nature.
- II. Larva just escaped from egg. Magnified. After Newstead.
- III. Larva fully developed. Magnified. After Newstead.
- IV. Larva, colour changed before first moult. Magnified. After Newstead.
- V. Larva, after moult. Magnified. After Newstead.
- VI. Pupa (Male). Magnified. After Newstead.
- VII. Pupa (Male), dorsal view. Magnified. After Newstead.
- VIII. Puparia of Adult Female, ventral view disclosing female and eggs. Magnified. After Newstead.
- IX. Male, Perfect Insect. Magnified. After Newstead.





CHAPTER CXIV.

ROSE AND RASPBERRY SCALE.

*(Diaspis rosæ, Sandberg.)*Order : *Hemiptera*. Family : *Coccidæ*.

Maskell gives the following description :—"Female puparium nearly circular, white, often aggregated in masses, diameter about one-twelfth of an inch. Male puparium white, elongated, carinated, length about one-twentieth of an inch. Adult female a deep-red in colour, elongated, the body deeply segmented. Cephalic region very large, smooth, on each segment of the body several spiny hairs ; five groups of spinnerets, no single spinnerets. Adult male (see Fig. IX.) orange-red in colour ; antennæ, ten-jointed, with several hairs on all but the first two joints ; feet slender, hairy ; digitules fine hairs. The spike is somewhat long."

This well-known and very destructive scale is easily distinguished from most other kinds by the large numbers of flat white scales adhering to the stem of rose bushes, as shown in Fig. I. In Victoria, this scale must have been introduced a long while ago, as it was here in the early fifties ; the probability is that it came on roses from the old country. This is a scale which, if not checked, will spread very rapidly. Newly imported roses when planted out are especially liable to attack. Infested plants soon show the weakening effect on the plant owing to the damage done by the sucking of the juices of the plant through the rostrum or beak of the insect. Hence it happens, as a matter of course, that the application of any fluids to the trees externally, with the object of poisoning the insects in their feeding, is, as Maskell remarks, useless, as their food is drawn from beneath the surface.

It has been said that this scale will also attack the roots of roses. This is not my experience, although I have frequently found it close down to the ground line; I have banked up the soil for a few inches, but always found that the buried insects made no headway, and under the lens appeared to be sickly and shrinking. Of course, the nature of the soil will have something to do with this; the air would not be freely admitted if it were heavy and of a sticky nature.

In America, Australia, and elsewhere, it has been found that this scale will also attack the stem and the roots of the raspberry, blackberry, and currant.

Prevention and Remedies.

In places where the scale insect exists, or has been known to exist, a strict watch should be kept, and a preventive, such as a light spraying with a weak, 1 in 30, kerosene emulsion, would be beneficial. This should not be carried out until the foliage has ripened, and should be done carefully and intelligently.

In treating roses for scale, the best rule to lay down is to attempt to eradicate it in the winter. Some roses require severe pruning, others light pruning, but all scale-infested prunings should be burnt on the spot, or as near to it as possible, always remembering that it is by means of cuttings or roots of plants that this pest is distributed. When the scale is down near to the surface of the soil, bank up the soil round the stem of the plant to about 3 inches, less in heavy soil, and about once a week fill up with ordinary soap suds. This is easily done, is inexpensive, and, as I have for a number of years proved, entirely effective. It also promotes the growth of the plants themselves.

In Victoria, at any rate, the "Dog Rose" stocks do not seem so liable to be attacked as are those roses budded upon other stocks; and, as every practical rose-grower knows, the so-called hybrid perpetuals are more liable to attack than are the teas and other sections.

In the cooler districts of the State, growers of small fruit, such as raspberries, currants, &c., should keep an active look-out for this scale. Should its presence be suspected, the Entomologist should be at once notified, and the case will be promptly attended to. In the meanwhile, all affected prunings should be at once burned.

PLATE CIX.

“SHE-OAK SCALE” (*FRENCHIA CASUARINÆ*, MASKELL).

Fig.

- I. Branch of Coast She-oak (*Casuarina quadrivalvis*), showing tubes, or coverings to insects, with bark cut away to show scar when tube is removed. Natural size. From nature.
- II. Tube, showing closed extremity. Natural size. From nature.
- III. Tube, showing both ends open. Natural size. From nature.
- IV. Base of tube with convex extremity of enclosed insect.
- V. Tube cut open, empty. Natural size. From nature.
- VI. Diagram of Female in tube. Natural size. From nature.
- VII. Adult Female, side view. Natural size. From nature.
- VIII. Abdominal extremity of Female. Magnified. After Maskell.
- IX. Extreme tip of abdomen with anal orifice. Magnified. After Maskell.
- X. Female of second stage (Diagram). Magnified. After Maskell.
- XI. Antenna of Female, second stage. Magnified. After Maskell.
- XII. Spinnerets of Female, second stage. Magnified. After Maskell.
- XIII. Rostrum and mentum of Female, second stage. Magnified. After Maskell.
- XIV. Larva, dorsal view. Magnified. After Maskell.
- XV. Larva (Diagram). Magnified. After Maskell.
- XVI. Antenna of larva. Magnified. After Maskell.
- XVII. Foot of larva. Magnified. After Maskell.



C. C. Brittlebank, Del.

C. French, Direxit.

Osboldstone & Co., Print.

Plate CIX.

CHAPTER CXV.

SHE-OAK SCALE.

(*Frenchia casuarinæ*, Maskell.)

Order : *Hemiptera*. Family : *Coccidæ*.

This remarkable insect, which is probably one of the most singular in the world, was first brought under scientific notice by the writer. It was found by me on She-oaks, *Casuarina quadrivalvus* especially, growing on the sea coast at Sandringham and other places not far from Melbourne. Having noticed a number of these fine and beautiful trees either dead or dying, I set to work to ascertain, if possible, the cause. I found nearly the whole of the branches studded with a hard and singular gall, which, upon raising the extinguisher-like cap or covering, disclosed a pink jelly-like animal, as shown in Fig. VII. This was to me a mystery, as I could not conceive it possible that an animal of so frail a texture would do so much damage to trees of a specially hardwooded nature.

There was, however, no doubt as to the real cause having been found, so I sent the specimens, with notes, to the late Mr. Maskell, of New Zealand, the Australasian authority upon scale-insects and their allies. These insects were a puzzle to Mr. Maskell, but he went to work and figured the specimens, naming the genus *Frenchia*.

In later years, Mr. Lea, F.E.S., State Entomologist, Tasmania, obtained living specimens from myself and others, and succeeded in finding out certain important matters connected with the life history of this extraordinary insect, and I cannot do better than quote from his able paper on the subject.

“ Perhaps the most remarkable of all the gall-forming insects are the species of *Frenchia*, all of which attack the *Casuarinas*, or She-oaks. There are two species now known, one from Sydney, where it appears to be very rare, the other from Victoria and Tasmania; the latter species is known as *Frenchia casuarina*, and frequently kills branches of She-oaks. Its larvæ, when young, are in appearance much like those of other members of the family, being provided with three pairs of legs, a pair of compound eyes, and a pair of antennæ. After leaving their mother gall, they wander over the bark, and finally settle down. Here they cause galls to form, the galls in time completely covering them. The galls continue to grow, and eventually from the middle of each gall a cylindrical woody growth appears, which may be readily detached.

“ Meanwhile, changes have been taking place in the insect itself; it loses its legs, antennæ, and eyes, and even its mouth parts (henceforth receiving its nourishment through its skin by the process known as osmosis), and appears as a little brownish object of irregular shape, but having a small node at its lower end, and a sort of thick tail at one side. As growth continues, the tail becomes thinner and increases in length, extending almost the whole length of the woody growth; its bottom also becomes saucer-shaped, but still with the small node which is fitted into a depression in the wood; it is doubtless at this stage that pairing takes place. Later on, the tail collapses, bends over, and appears fitted to a remarkable cap, which is joined to the body by an irregular suture, much as the sutures of the bones between the human skull. The body itself is now shaped like a wad, and, on removing the cap, the top can be seen to be completely covered by fine concentric rings, with a small opening in the centre, from which the young can be nearly always seen escaping. A heavy coating of white mealy substance is always attached to the wall of the enclosing gall, while the insects are healthy, but when these are attacked by parasites, as

is often the case, this substance disappears. When fully fed, the lower portion of the gall is completely filled, and doubtless gives to the insect its peculiar wad-like shape. The trees attacked by these insects are often killed by them, and the galls are frequently to be seen in immense numbers.

“Common as the females are, the male has never yet been described, and has probably never been seen, although it has been keenly searched for; it will probably be much the same, however, as many others of the same family.

“Briefly summed up, the life history of this insect, probably the most remarkable in Australia, if not in the whole world, is as follows:—

“1. Born in possession of six legs, two compound eyes, a pair of antennæ, and with mouth parts.

“2. Attacks bark, and causes compound galls to form.

“3. Gains a tail, but loses its legs, antennæ, eyes, and mouth parts; at this stage completely cut off from the outer air. From now onwards nourished through its skin.

“4. Again changes its shape, tail becomes semi-detached from the body, the upper surface of which is marked by several concentric rings.

“5. Females abundant; male unknown.”

It is fortunate for our orchardists that, although this insect must have existed from the earliest times of fruit-growing in Victoria, it has so far never been known to attack fruit trees, or, in fact, introduced trees of any kind whatever. This does not imply, however, that it may not do so, like many other serious pests have done before, as they may find an easier mode of living, viz., on introduced fruit trees.

In the early days of Victoria, the coast-line, say from Brighton to Cape Schanck, was thickly studded with She-oak trees, the drooping one (*C. quadrivalvis*) being the

kind which grew nearest the sea; the more erect species is found more inland. In the early fifties the writer recollects that quite a fleet of small craft was engaged in the firewood trade, with head-quarters at Dromana, at which place, long before a pier was thought of, thousands of tons of this firewood might have been seen stacked for shipment to Melbourne. With the exception of the wattle, the She-oak is the best wood for bakers' purposes available. As a shelter tree for sea-shore purposes, it has no equal, the roots being mostly surface ones, and therefore useful for binding, and arresting erosion caused by the action of wind and wave combined. As a shelter tree, it may be observed that the *Casuarina* is one of the most valuable, growing with the Wattle in places where little else would thrive, making at once a shelter for stock, being useful as well as ornamental.

The hardness of this insect, as also others of the same group, is shown by the fact that when on the sea-coast they will survive strong winds and salt sprays which are so deadly to most vegetation, and also to soft-bodied insects. *Aspidiotus rossi*, a flat black scale, common to Blackwood and others of our native trees, will thrive on coast plants which are at high tide partially submerged by the sea; and the scale now dealt with is equally hardy, but much more deadly in its effects than are most members of this large and highly interesting group of insects. It must not be supposed, however, that this Horn Scale is confined to the coast; on the contrary, it is common on the She-oaks growing on the wind-swept hills of Myrniong, Blackwood, and other inland parts of the State.

As this insect is of such extraordinary interest, especially to naturalists, I have given a more detailed plate than usual.

Prevention and Remedies.

It has been suggested that this pest will attack only old or full-grown trees. I have proved this to be an erroneous

idea, as it will attack plants of *Casuarina* when these are only 8 or 10 feet in height, so that persons going in for plantations would do well to be on the alert; a spraying with some cheap deterrent, such as tar water, would most likely prevent the young plants being attacked. As the cultivation of such a valuable commercial timber as the She-oak is sure to be largely extended in the near future, it behoves all to keep a keen lookout; when a large tree is attacked (I have seen thousands of galls on one tree), there is but little hope of successful treatment.

This pest has been found growing plentifully on trees in close proximity to orchards, but, as before stated, it has, so far as we know, kept to the She-oaks—both of the common kinds. Although this is one of the most valuable and handsome of the native trees, it would be well to remove them if found growing near to an orchard, and the same remark would apply to Wattles.

PLATE CX.

“ SWEET-POTATO WEEVIL ” (CYLAS FORMICARIUS, FABR.).

Fig.

- I. Tuber of Sweet-potato, showing damage. Natural size. From nature:
- II. Perfect Insects. Natural size. From nature.
- III. Larva. Natural size. From nature.
- IV. Pupa. Natural size. From nature.
- V. Perfect Insects. Magnified. From nature.
- VI. Larvæ. Magnified. From nature.
- VII. Pupæ. Magnified. From nature.



CHAPTER CXVI.

SWEET-POTATO WEEVIL.

*(Cylas formicarius, Fabr.)*Order: *Coleoptera*. Family: *Curculionidæ*.

This very destructive pest was first noticed here by myself as having worked havoc with consignments of sweet potatoes which were being sent to Melbourne in great quantities from Queensland. As the plate shows, the tubers are absolutely unfit for food when badly attacked. The beetle responsible for this wholesale destruction is one of the *Curculionidæ* family, and it is somewhat ant-like in shape; hence its specific name.

The body of the beetle is smooth and shiny, the abdomen being of a beautiful steel-blue colour. The other parts are mostly red-black. The rostrum, or beak, by which the skin of the potato is pierced, is strong for so small an insect, which is wingless. The larva, or grub, is white, and about a quarter of an inch in length, and, as the plate shows, it tunnels into the tubers, rendering them useless. The skin is pierced by the female beetle, and in these punctures the eggs are laid, and the young grubs at once commence to eat into the tubers. As Mr. Tryon remarks, no species belonging to the genus *Cylas* has so far been recorded as being indigenous to Australia, so that this pest is another bad importation from abroad.

In Mr. Tryon's valuable work, he says—"At present (1889), I only know of its occurrence in the East Moreton district of Queensland." But as the sweet potatoes which we discarded here were not from the above district, it is evident that the pest has spread, but to what extent I do not know. When first observed in Victoria, a quick and

concerted raid was made on all the shops in the City and suburbs, and, when the pest was found, it was promptly and effectually dealt with; the prohibition of sweet potatoes from Queensland quickly followed.

Prevention and Remedies.

As sweet potatoes are not likely to be largely grown in Victoria, although they will thrive in the warm part of the State, it will suffice if I give Mr. Tryon's advice:—

“We would suggest that the tubers should be unearthed as a demand for them has arisen, and consumed with as little delay as possible. All the affected ones should be destroyed, or used as food for stock; also, if practicable, in a district where it manifests itself, all the sweet potatoes raised there should be consumed on the spot, and during the succeeding season no sweet potatoes should be grown.”

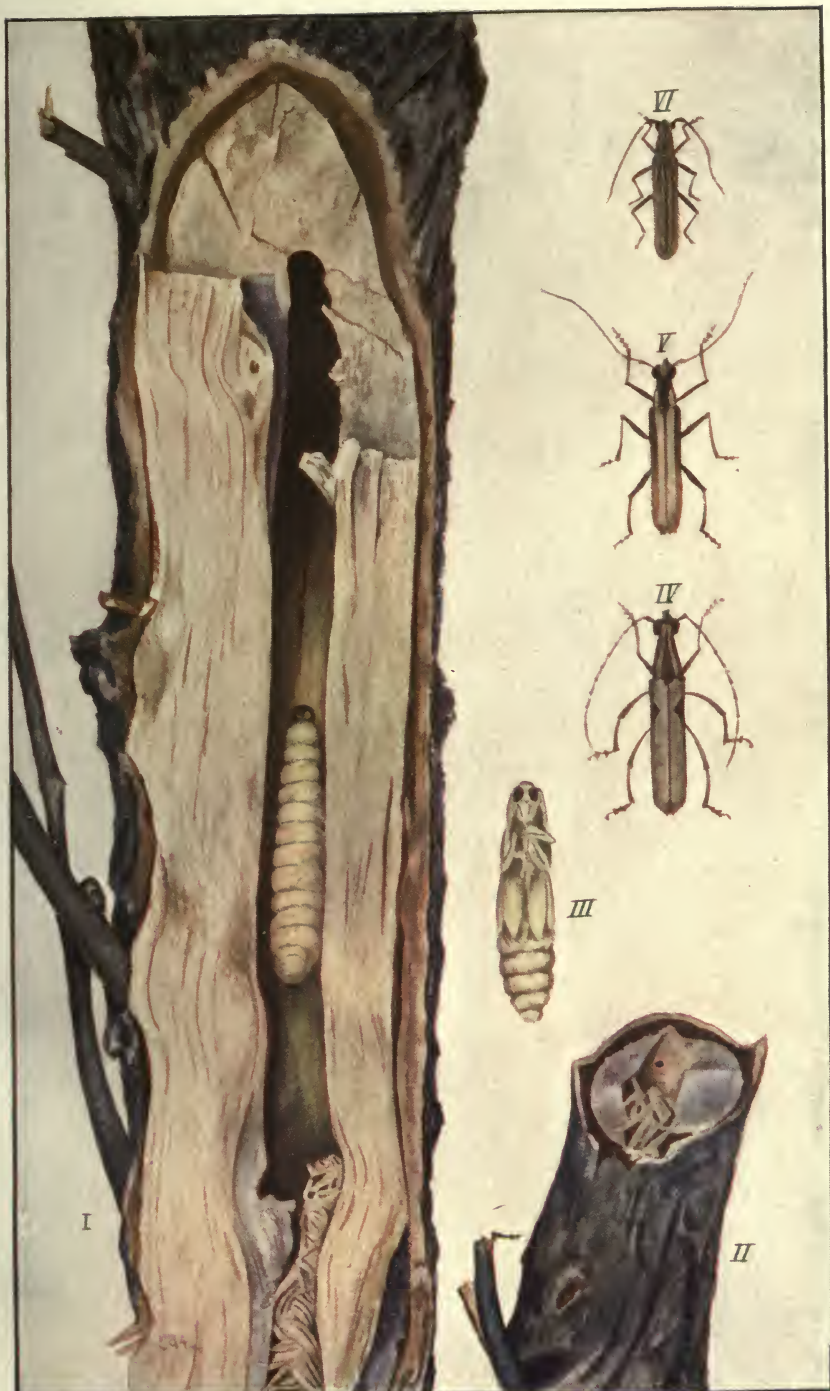
As this pest, like the root borer, is without proper wings, the danger of spreading would be largely minimized; but it might be spread by other agencies, such as dirty bags in which sweet potatoes have been carried. We have too many pests already, and who knows whether these beetles may not take a fancy to our potato crops? We must keep a strict watch on these matters, and, above all, when the pest is discovered, act promptly and persistently, as by such means only can the trouble be brought under control or, better still, stamped out.

PLATE CXI.

“URACANTHUS TIMBER BORERS” (URACANTHUS STRIGOSUS,
U. BIVITTATA, U. SIMULANS).

Fig.

- I. Specimen of composite plant (*Helichrysum ferrugineum*), showing larva, &c.
- II. Specimen of composite plant (*Helichrysum ferrugineum*), showing horizontal cut made by larva. Natural size. From nature.
- III. Pupa of Beetle, *U. simulans*. Natural size. From nature.
- IV. Perfect Insect, *U. simulans*. Natural size. From nature.
- V. Perfect Insect, *U. bivittata*. Natural size. From nature.
- VI. Perfect Insect, *U. strigosus*. Natural size. From nature.



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CHAPTER CXVII.

URACANTHUS TIMBER BORERS.

(*Uracanthus strigosus* ; *U. bivittata* ; *U. simulans*.)

Order : *Coleoptera*. Family : *Cerambycidae*.

The three species of timber-boring beetles treated in this chapter represent a genus of very handsome though destructive Longicorn (long-horned) beetles, of which there are a good many described from Australia.

The beetles, as shown in our plate, are mostly long and narrow in shape. The larvæ are fairly active footless grubs. The eggs are deposited in crevices in the bark, and, when hatched, the young larvæ commence to bore for their natural food. Haunts of beetles of this genus, and in fact many others of the longicorn family, may be located by the cut-off appearance of the bough (see Fig. II.) ; and the tow-like stopping indicates the presence of the larvæ at work in the wood below.

The larvæ of the genus *Uracanthus* are not at all particular as to the kind of trees they attack. They have been found in *Acacias*, the Giant *Helichrysums*, in the common introduced Furze or Gorse, and in other plants, both indigenous and introduced. On the fringe of our sea coasts the larvæ of some of these beetles do great damage to the natural shelter trees, particularly to two of the *Acacias*, viz., *A. longifolia* and its variety *sophora*. It is no uncommon sight to find the whole plant riddled with larvæ, the sickly appearance of the tree being to observers a sure indication of the trouble going on inside.

These beetles, in common with most species of the same family, are night flyers. Upon emerging from the pupa, in a mummy-like form of the perfect beetle, it ascends to the tops of the tree, and there remains until the late twilight, when it takes wing. Although the beetles may appear scarce, they are nevertheless quite common, and are easily attracted by a bright light. The larvæ of the large kinds of *Uracanthus*, at any rate, lie very close in their self-constructed tunnel, and, upon being handled, they become fairly lively, when exposed to either light or air.

Fig. IV. shows a species which has lately come to light in Victoria, although it has long been known in South Australia. It is a very pretty and distinct kind. Our plate shows the larva of one of the largest species at work. I have lately received what appears to be a giant species of *Uracanthus* from the scrubs of semi-tropical Queensland.

The longicorn family includes in its ranks some of the largest known beetles, the larvæ of which are frequently used by natives as food. A good female specimen of *Titanus giganteus* from Cayenne will measure at least 9 inches in length of body, so it may be imagined what damage these huge beetles do in the forests of tropical countries. In Victoria, where a deal of timber comes in from many parts of the world, there is a great danger of some of the worst timber-borers being introduced by this means, and several very destructive kinds have already been found in the City. There should, therefore, be constant vigilance by persons familiar with the insects, not only of our own State, but with those of other countries also.

Prevention and Remedies.

On small areas, kerosene and a little oil of tar mixed sprayed on to young or small trees will keep the female from depositing her eggs, but the spraying will of course have to be renewed. The beetles appear from December to April as a rule, so this would be the best time to use the

preventives. When the trees have been attacked, examine the branches well, and cut off every affected limb, or at least a portion of it, and, as I have before mentioned, a little practice will soon enable any one to locate the larvæ at their work. In badly affected districts, a bright lamp placed inside a tent will attract numbers of these night-flying insects, when the captives can either be destroyed or kept for the cabinet collection.

PLATE CXII.

“YELLOW-BOX BORERS” (PHORACANTHA TRICUSPIS, AND
P. RECURVA).

Fig.

- I. Perfect Beetle, *P. tricuspis*. Natural size. From nature.
- II. Perfect Beetle, *P. recurva*. Natural size. From nature.
- III. Portion of Yellow-box Tree, showing workings. From nature.



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Plate CXII.

CHAPTER CXVIII.

YELLOW-BOX BORERS.

(*Phoracantha tricuspis* and *P. recurva*.)

Order : *Coleoptera*. Family : *Cerambycidae*.

These are two of our finest but terribly destructive Longicorn or long-horned beetles. The former, *P. tricuspis*, is the largest known species of the genus, and the figure, which is life size, shows that it is of a light-brown colour, with a few darker-brown markings on the elytra. The head and thorax are very dark-brown, the latter being much wrinkled. The antennæ are of the same colour, and frequently half as long again as the beetle itself.

The eggs are deposited in the crevices of the bark, nearly always in the bark of *Eucalyptus viminalis*, a tree formerly very common around Melbourne. The larvæ are stout, footless grubs, which bore with rapidity. When in the pupa stage, they assume very much the form of the perfect beetle, but mummy-like. The antennæ and legs are stuck in close to the body, the whole being of a yellowish-white colour, and quite soft to the touch. In the early summer, these beetles may be seen emerging from the side of the tree. Here they rest until hardened by exposure, and then ascend the tree, where they remain until night comes on. They are then strong enough to fly, which they do fairly quickly.

The male, as in the case of Longicorn beetles generally, is smaller than the female, and usually has longer antennæ. The genus *Phoracantha* comprises a good number of species, and these, together with those of its ally, *Tryphocharia*, are all more or less destructive to timber.

During the last twenty years or so, the trees of *E. viminalis* have largely disappeared, so that many insects, which formerly bred in it, have taken to the Yellow Box (*E. melliodora*), which still exists in fair quantities. Our plate gives a representation of a piece of Yellow Box attacked by these and other insects; the perfect beetles have already emerged from the timber.

Phoracantha recurva is a much smaller insect, but plays great havoc in the wood, mostly in the branches. Mr. Tepper, the veteran entomologist of South Australia, remarks that in South Australia this beetle only attacks ring-barked or felled timber. This is certainly not the case in Victoria, as in hot weather I have frequently seen the green branches, when fallen from the tree, with the beetles emerging from the wood. The tunnels are easily recognised by those acquainted with the life-history of Victorian insects. This species may be identified by its long saw-like antennæ, which are also strongly spined.

Phoracanthas are widely spread. I have had the former species from Melbourne to Northern Queensland, whilst the smaller species, *P. recurva*, is listed from nearly every known portion of Australia, and is as common in Queensland, Western Australia, and Northern Territory as it is in Victoria. It is also found in Africa. Both species, and, in fact, most others of this genus, are also to be found hiding under the loose bark of some of the larger gums, such as the Red Gum, Blue Gum, and others.

When captured, these beetles make a noise resembling grating or squeaking. On hot sultry summer evenings, both of these species may frequently be seen flying in the twilight, but the nocturnal birds destroy great numbers of these and other night-flying insects.

It has always appeared to me strange that so few of our numerous native timber-borers appear to have taken to our fruit trees; one would imagine that the bark of the

apple, pear, plum, and other similar fruit trees would be more palatable than that of the astringent bark of the *eucalypts* and *acacias*.

Fortunately, so far as we are aware, neither of these beetles has as yet attacked orchards, or, in fact, any introduced trees ; but as the smaller one, at any rate, is common in parts where there are but few if any gum trees in the neighbourhood, it is reasonable to believe that it must breed in one of the *Acacias*, which plants largely comprise the arboreal vegetation of the more arid parts of Australia.

Prevention and Remedies.

As a rule, neither of these two beetles is to be found in saplings, so that a watch should be kept on larger forest trees, and, where the sawdust appears, the parts attacked should if possible be removed. In parts where these occur plentifully, a good many of the perfect beetles, both male and female, may be captured by means of a strong light thrown against a blanket or a sheet stretched between the trees or poles. The blankets are best, as the hooked tarsi, or feet, become fastened in the blanket, and hence the beetles are more easily captured, whereas, when calico is used, they simply fly up against it, and, recovering, soon take wing and are off.

Our gigantic spider (*Voconia*) is very destructive to beetles that hide themselves under bark or logs, the numerous wing-cases, legs, and other remains testifying to the slaughter going on.

PLATE CXIII.

“RICE WEEVIL” (*CALANDRA ORYZÆ*, LINNE).

“GRAIN WEEVIL” (*CALANDRA GRANARIA*, LINNE).

“NUTMEG BEETLE” (*ARÆOCERUS FASCICULATUS*, DE GEER).

Fig.

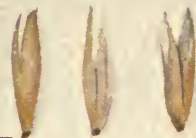
- I. Perfect Insect (Rice Weevil). Enlarged. From nature.
- II. Perfect Insect (Rice Weevil). Natural size. From nature.
- III. Injured Rice. Natural size. From nature.
- IV. Perfect Insect (Grain Weevil). Enlarged. From nature.
- V. Perfect Insect (Grain Weevil). Natural size. From nature.
- VI. Injured Grain (Wheat, Barley, Oats, and Maize). From nature.
- VII. Perfect Insect (Nutmeg Beetle). Enlarged. From nature.
- VIII. Perfect Insect (Nutmeg Beetle). Natural size. From nature.
- IX. Sections of Injured Nutmegs. From nature.



II.



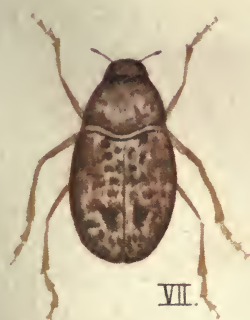
III.



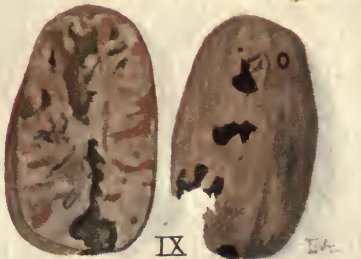
VI.



V.



VIII.



IX.

CHAPTER CXIX.

RICE WEEVIL.

(*Calandra oryzae*, Linne.)

GRAIN WEEVIL.

(*Calandra granaria*, Linne.)

Order: *Coleoptera*. Family: *Curculionidæ*.

NUTMEG BEETLE.

(*Aræocerus fasciculatus*, De Geer.)

Order: *Coleoptera*. Family: *Anthribidæ*.

RICE WEEVIL.—The first named of these three serious pests is but too well known, and has been well established in all the grain-growing districts of Australia for many years. It causes an immense amount of damage to wheat and maize in all parts of New South Wales, but particularly in the North and North-western districts. As Fig. I. shows, the beetle is reddish-brown in colour, with four lighter-coloured spots or blotches on the wing cases.

Mr. Froggatt says that the parents sometimes infest maize while in the field, but seldom, if ever, before it is bagged, so that it is in the ill-constructed granary where the damage is done. Experiments conducted by Chittenden and others prove that the germination for the development of this egg into a larva, and from that into a beetle, may be retarded for months under certain conditions; but let the wheat be stored in warm, badly ventilated, or low-roofed grain stores, and the birth and growth of the young beetle are very rapid. Chittenden says it has been estimated that one pair will, in the course of a year, produce 6,000 descendants. In some samples of wheat, after being kept by Mr Froggatt enclosed in screw top jars

for twelve months, 970 grains of wheat yielded 460 weevils ; all of these were in the grain in the grub state when it was placed in the jar.

These tiny beetles gnaw a hole into the side of the grain, and in this deposit an egg. In some cases, the Jumping Bean, for example, the grub is in the centre of the bean, and only with the aid of the lens can the smallest hole be detected ; hence it happens that the larvæ, by some muscular movements, causes the bean to move (jump), and in some parts of the world affords endless amusement. Some years ago a Melbourne firm imported a quantity of Jumping Beans, but as this meant the introduction of a new pest, entomologists did not appreciate them, and the whole were promptly destroyed.

The Rice Weevil, unlike the Grain Weevil, can fly, and this fact renders it more formidable. At the present time, it is found in most countries, and will even thrive in the coldest parts of North America, &c. In Victoria, this insect is very plentiful, and, in addition, cargoes of rice and other grain have to be specially watched and inspected, and if found affected treated as recommended in the latter part of the chapter.

GRAIN WEEVIL.—Regarding this tiny pest, Mr. Froggatt offers the following remarks :—

“ Though the common brown wheat pest is usually called the Grain Weevil, it is the one described by Linnæus under the name of *Calandra oryzeæ*—that is, the universal pest. This is somewhat of a misnomer, as it is a comparatively rare beetle, without the same powers of flight. It is somewhat larger than the former, without the blotches on the wing covers, and the punctures on the thorax deeper and more distinct. In Victoria, this pest is a real scourge in granaries, and appears in enormous numbers.”

NUTMEG BEETLE.—This is another serious pest, and a fitting companion to the two already described. According to Masters, this beetle is a native of Australia, although we have often found it in imported nutmegs. On that

account, it has been proclaimed a noxious insect under the Vegetation Diseases Act.

This beetle is light-brown in colour, and one of the well-known Anthribid form and peculiar appearance. The *Anthribids* from New South Wales and Queensland are usually found on the trunks of dead trees, where they hunt for and devour the small wood-boring beetles that are attracted to the dead twigs, or which breed out of fungi. *Doticus pestilans* is common in Victoria, and although, as a rule, it attacks apples which are left on the trees after the main crop has been picked, those which are still juicy are also affected.

The Nutmeg Beetle requires watching, and all oversea shipments, if found infested, should be treated before the cargo is allowed to go into consumption.

Prevention and Remedies.

There would appear to be no better plan than keeping the grain and nutmegs in properly constructed mills or stores. Even then, no matter how careful the owner may be, weevils and beetles of similar habits manage to find their way into most stores. To overcome the pest, the bi-sulphide of carbon treatment has been adopted. In the large granaries of the United States, as Chittenden and others tell us, the material to be treated is heaped upon the floor. A tube or cylinder is pressed down to the centre of the mass, and into this the bi-sulphide of carbon is poured; a canvas cover is then thrown over the lot for about 24 hours. This material must be used with care, as it is highly explosive. When used at close quarters and for any length of time, severe headaches, as I have frequently experienced, follow. In designing a place for treating grain with this material, provision should be made whereby the doors may open inwards. After treating grain, the door should be thrown open for at least an hour before any one enters the building, so as to allow the fumes to escape.

Experiments have been carried out in America to ascertain the action of bi-sulphide of carbon upon the germination of wheat, and it has been proved that it can be exposed for 36 hours without injury; and for 24 hours without spoiling it for milling purposes. One pound of bi-sulphide of carbon costs in Melbourne about sixpence, and this quantity is sufficient to treat about 100 bushels of grain. In America, where the carbon is cheaper, it has been estimated that, in a close building, 1,000 cubic feet of space costs ten cents, so that 1 ton of wheat can be fumigated for ten cents. In India, it has been proved that bi-sulphide of carbon is a perfect preventive against weevils in grain; that its action lasts, if the building be hermetically closed, six weeks, after which period a fresh charge of the agent is required; that, even in samples which have been attacked by weevils, the effect of bi-sulphide of carbon is immediately felt, the weevils disappearing in masses. This chemical does no harm to grain as regards its colour, smell, and cooking properties.

Mr. Froggatt, in one of his reports, states that several millers have informed him that, if the bags of grain or flour are stood on end when stacked, they resist the attacks of all pests much better than if stacked on the flat. It is also a well-known fact that if clean grain is placed in a salt bag, no weevil will infest it. The question then arises, could not the corn sacks be dipped in brine and dried before being used in the harvest field. The cost would not be much, and, though the salted corn sacks might be liable to absorb a certain amount of moisture from the atmosphere, it would not be sufficient to injure the grain enclosed.

For treating both zoological and botanical specimens which have been attacked by this pest, the carbon bi-sulphide is an excellent remedy, and for painting dried specimens of plants in a herbarium formalin is now preferred to the corrosive sublimate (bi-chloride of mercury) so largely in use in the herbaria of Europe and elsewhere.

PLATE CXIV.

“CURVED WING-CASE TIMBER BORER” (*PLATYPUS CUPULATUS*,
CHP.).

Fig.

I. Wood section, inside view. From nature.

II. Wood section, outside view. From nature.

III.-IV. Perfect Beetles. Natural size. From nature.

V. Perfect Beetle. Magnified. From nature.

VI. Perfect Beetle (side view). Magnified. From nature.



CHAPTER CXX.

CURVED WING-CASE TIMBER BORER.

*(Platypus cupulatus, Chp.)*Order : *Coleoptera*. Family : *Scolytidæ*.

This tiny but destructive insect has been found by my Assistant, Mr. C. French, jun., in timber imported into Victoria for furniture making. The logs are taken to the timber yards, and often stacked amongst other timbers. As the plate shows, this beetle is a very small one, with the terminal parts of its elytra or wing cases in-curved (see Figs. V. and VI.). The timber illustrated is a portion of a log sent from the Malay Peninsula. Importations from this and other places in the East are a distinct menace to our timber yards, as there is a grave danger of the pest spreading to other timbers, and also to furniture, public buildings, shipping, &c.

The family *Scolytidæ*, to which this beetle belongs, embraces some of our very worst timber-boring insects; and in Europe the splendid avenues of elm trees have frequently been destroyed by the well-known *Scolytus destructor*. The method of attack of the pest has been well described by the celebrated naturalists, Andouin and Spence—" . . . both the male and female insects attack the tree for the purpose of obtaining food, burrowing into the trunk. This brings the tree to a state of ill-health, which is adapted for the reception of the eggs and for food for the larvæ. The female insect then burrows into the trunk, and there deposits her eggs; and the larvæ when hatched form cylindrical galleries, diverging at right angles from the trunk of the parent, and parallel to each other, within which they also become pupæ, and so great is the fecundity of these insects that their countless numbers are soon sufficient to destroy the largest tree."

The larvæ, or grubs, although small, play great havoc with the timbers. This family of beetles is closely allied to the so-called Weevils or *Curculionidæ*; and are fairly numerous in tropical countries, where they do damage, not only to timber when growing, but also to joists and beams in houses and to furniture. I am indebted to Messrs. Lea and Froggatt for data in connexion with this pest.

In Masters' catalogue of Australian beetles, 3 species are listed, but some of these may be importations from the East. Dejean gives 24 species from the tropics, but at the present date 100 species must be nearer the mark.

Prevention and Remedies.

All timbers coming here, especially from the East, should be carefully examined by an entomologist, before being permitted to be removed from the wharfs. Upon the first signs of the existence of the pest, the timber should be "held up" for treatment.

Spraying with corrosive sublimate, carbolic acid, preservative oil, or other such material, will be effective. In cases of small consignments, fumigation with cyanide of potassium in gas form or bi-sulphide of carbon may be resorted to. Timber which is too far gone to treat successfully should be at once rejected. We cannot be too careful in regard to foreign shipments, as, once the pests are introduced, they usually come to stay.

PLATE CXV.

“ LESSER DRIED FRUIT MOTH ” (*Plodia interpunctella*, Hb.).

Fig.

- I. Larva of Moth. Natural size. From nature.
- II. Larva of Moth (partly enclosed). Natural size. From nature.
- III. Pupa of Moth. Natural size. From nature.
- IV. Perfect Insect (wings closed). Natural size. From nature.
- V. Perfect Insect (wings expanded). Natural size. From nature.
- VI. Almond cut and showing damage done. Natural size. From nature.
- VII. Group of Almonds destroyed. Natural size. From nature.



CHAPTER CXXI.

LESSER DRIED FRUIT MOTH.

*(Plodia interpunctella, Hb.)*Order: *Lepidoptera*. Family: *Pyralidæ*.

This very destructive moth belongs to the well-known group of *Pyrales*, which includes most of those doing damage to cereals, fruits, &c., when in the prepared state.

Dr. L. O. Howard, Chief Entomologist of the United States, and Mr. Chittenden, also of the Entomological Staff of the same country, state that "the adult moth has a wing expanse of between half and three-quarters of an inch. The outer two-thirds of the fore wings are reddish-brown (see Fig. V.), with a coppery lustre. The inner portion and the hind wings are a light dirty-grey in colour, being whitish, with light-rose, yellowish, and greenish tints. The pupa is light-brown in colour."

"The eggs are minute, and white, and are deposited to the number of 350, singly and in groups of from three to a dozen or more, upon whatever substance the female may see fit to select for the sustenance of her offspring. They hatch in about four days, and in four or more weeks another brood is produced. In this manner, a succession of generations appears. According to the temperature of the building which the insect inhabits, these will vary from four to possibly six or seven a year. The caterpillars spin a certain amount of silk as they feed, joining together particles of their food and excrement, and thus injuring several times the amount of material they consume. When fully matured, they crawl hither and thither, trailing large quantities of their silken threads after them in their search for a suitable place for their transformation; and finally surround themselves in a cylindrical silken web, in which they change to chrysalids and then to moths."

This pest is common throughout Australia, and in Victoria it has given no end of trouble, the larvæ having been found in boxes of dried fruits, apples, peaches, apricots, figs, and prunes. It also breeds in walnuts, almonds, and seeds of various kinds, and especially in flour and grain.

In our plate we have endeavoured to give some faint idea of the damage done to dried almonds, the specimens from which the drawings have been made being taken from both imported and locally-grown products.

As showing the amount of damage which these insects have done to wheat, Mr. Froggatt states—"It has been bred in great numbers from a sample of wheat sent to me by the late James Stephenson (Secretary of the Board of Exports), with a note that 1,000 bags had been shipped to London, and that the wheat was said to have been grown at Coolamon, but there was some doubt about the exact locality. Soon after it had been placed in a jar, it was swarming with caterpillars, and the contents of the jar became so matted together with the silken filaments that they could be lifted out in an almost solid mass, and, on examination, fully 90 per cent. of the grains were found to have the end containing the embryo eaten out. Numbers of the larvæ were found in bran, and others in a box of dried raisins."

Mr. Froggatt states that in America it is called "The Indian Meal Moth," though even there it feeds upon all kinds of dried foods.

Prevention and Remedies.

Cleanliness in the store or factory, and a constant overhauling of the grain or dried fruits therein stored, would appear to be the best of preventive measures. Should the pest obtain a foothold, treating by either the excessive temperature process, or by a thorough fumigation, combined with a careful culling out of all the affected grain or fruit, seems to be the only successful methods so far

devised. In another chapter I have alluded to the very successful bi-sulphide of carbon treatment practised in the larger granaries and dried fruit stores, in the United States and elsewhere.

This insect is another of the curses introduced into the Commonwealth, and emphasizes the necessity for careful examination at the port of entry and the adoption of stringent measures. It is hardly necessary to point out to my readers the importance of the great cereal and dried fruit industries in Victoria, and this must be my excuse for the strong wording of the advice here tendered. In the United States the losses occasioned by this insect have been enormous, but by adopting sensible precautions the losses of former years have now been considerably lessened.

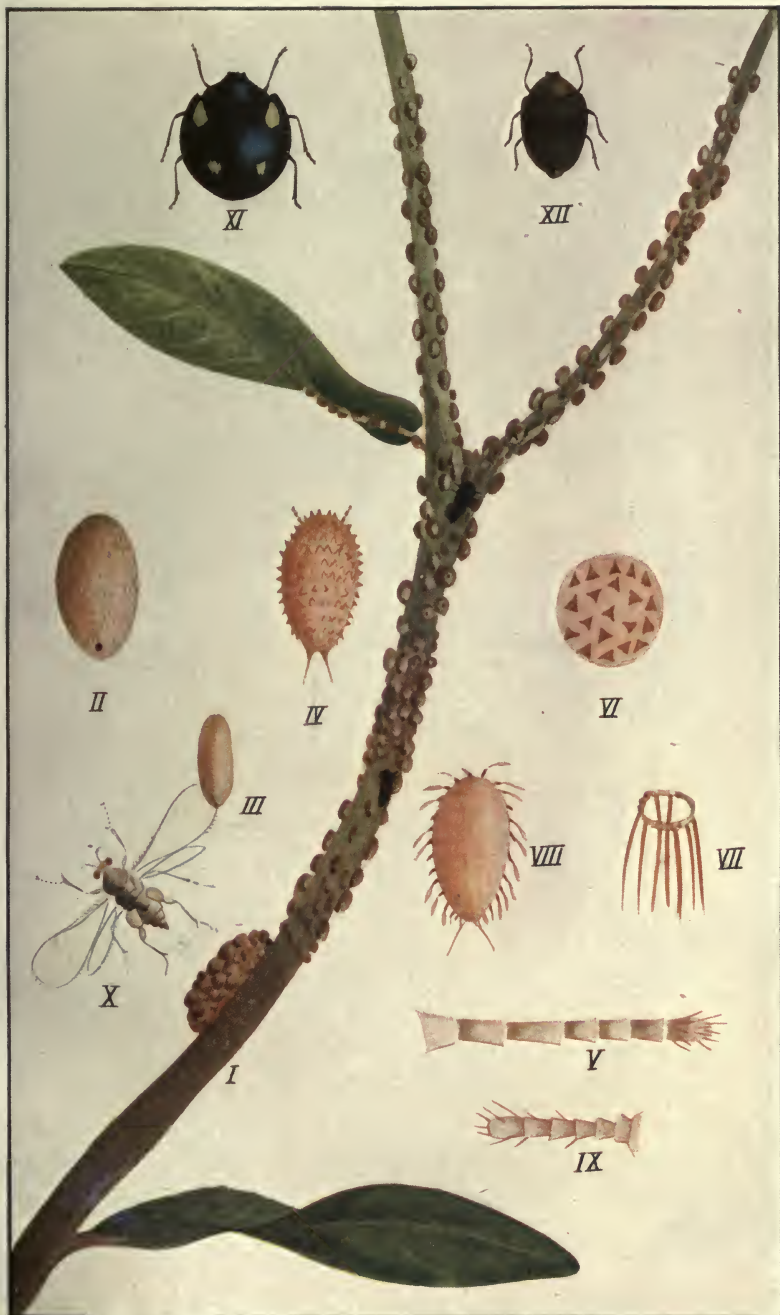
PLATE CXVI.

“COMMON GUM SCALE” (ERIOCOCCUS CORIACEUS, MASKELL).

Fig.

1. Eucalyptus branch with scale, also larvæ of Ladybird, *Scymnus* sp., also cocoon of Scale-destroying Moth, *Thalpochares coccophaga*, the larva of which constructs a cocoon with scale insects joined together by a silken web. Natural size. From nature.
2. Sac of Adult Female. Magnified. After Maskell.
3. Sac of Male pupa. Magnified. After Maskell.
4. Adult Female, diagram to show spines. Magnified. After Maskell.
5. Antennæ of Female. Magnified. After Maskell.
6. Dorsal spines of Female. Magnified. After Maskell.
7. Anogenital ring of Female. Magnified. After Maskell.
8. Larva. Magnified. After Maskell.
9. Antenna of larva. Magnified. After Maskell.
10. Hymenopterous parasite on scale. Magnified x 12. After Maskell.
11. Ladybird Beetle, *Orcus*, parasitic on scale. Magnified x 3. From nature.
12. *Scymnus* parasitic on scale. Magnified x 3. From nature.

The Eucalyptus leaves also show “Sooty Fungus,” caused by fungus parasitic on the sugar secreted by the scale insects.



C. C. Brattlebank, Del.

C. French Direxit.

Osboldstone & Co., Print.

Plate CXVI.

CHAPTER CXXII.

COMMON GUM SCALE.

(*Eriococcus coriaceus*, Maskell.)

Order: *Homoptera*. Family: *Coccidæ*.

The genus *Eriococcus*, to which *E. coriaceus* belongs, is but too well known to those accustomed to the forests of our State, and it has a wide range. *Eriococcus* was first described by the late Mr. Maskell in the *Transactions of the New Zealand Institute*, 1892, from specimens supplied to him by the late Mr. Olliff, Entomologist, of Sydney. The adult female, as Maskell describes it, is enclosed in an elongated sac of whitish or yellowish cotton; the body is elongated, segmented; anal tubercles conspicuous; feet and antennæ present; several rows of conical spines on dorsal surface; antennæ of six joints.

I have never seen the male, but in other species the adult male is a tiny fly-like insect, with hyaline wings, and, according to Comstock, with a pair of long, waxy filaments projecting from the posterior portion of the abdomen. These filaments are very conspicuous, and are whiter and longer than the body of the insect.

In the *Agricultural Gazette of New South Wales*, 1900, Mr. Froggatt gives an excellent account of this scale, as observed by him in New South Wales and elsewhere. It is generally found on young gum saplings that spring up when the larger trees have been cut down. It does not

confine its attacks to one species of *Eucalypt*, being found upon at least half-a-dozen. This scale has never yet been found on orchard trees, with the exception of a guava and a myrtle in a nursery ; and, as both of these belong to the same family, it is still more remarkable how this insect collects its food plant. This scale may be found more or less in the bush all the year round, but is most plentiful about the middle of October and November.

The larvæ vary in colour from yellowish to dull-red, are very small and active, and as soon as they are hatched out they crawl over the twigs till they find a hiding place. The full-grown female coccid is enclosed in a rounded, thick, felted, cotton sac, varying in colour from white to creamy-yellow, dark-orange, or even dull-red, attached to the bark at the base, with the apex opening out into a rounded orifice closed below at the tip of the abdomen, which lies level with the opening. These cottony sacs are closely packed against each other, so that the whole stem is frequently covered for inches right round. Though these sacs are naturally of the above colours, they are frequently smothered with fumagine, caused by the honey dew or superfluous juice of the plant. This they suck up in such quantities that they cannot retain it, but discharge it in the form of a fine spray, which, falling on the bark and foliage, forms a food for the smutty fumagine, the minute spores of which cover it and soon change it into a black skin. Each of these little egg-like sacs contains a female, which is capable of laying several hundreds of eggs ; these soon produce larvæ, further covering the infested tree.

Although this scale was only described by Mr. Maskell in 1892, it was well known in Victoria in the early days, the late Fraser Crawford and Mr. Tepper having paid considerable attention to it. It was photographed by Mr. Crawford as *Eriococcus eucalypti*, a most appropriate specific name. In the early fifties I first saw it in the

Moorabbin district, and since that time I have seen it in nearly every portion of Victoria which I have visited.

In most cases of scale insects, a vigorous growth will enable the affected plant to at any rate partly resist the attack, but with this scale it is different, as I have seen young saplings of Blue Gum, *E. globulus*, which were at the time making extraordinary growth, killed right out. The insects are in such vast numbers that spraying and other means adopted have but little effect upon them. In the Victorian bush, at any rate, the plants selected for attack are saplings of almost every kind of *Eucalypt*, and I have seen it both on the leathery foliage of *E. alpina*, also upon the Snow Gums at the Alps, where for several months of the year snow reigns supreme. In the Alpine regions of the State this scale does not appear to make much headway, which fact may be accounted for by the tough foliage of some of the *Eucalypts* in those places, and the effects of the freezing and the snow combined.

In New Zealand, this pest, which had probably been introduced from either Victoria or Tasmania, bade fair to put an end to the newly-made plantations of Blue Gums and other *Eucalypts*, and the situation may be described in Mr. Kirk's own words :—

“The appearance of an affected plantation was most uninviting. All the small saplings were completely covered with dense masses of the female sacs tightly packed together, and the smaller branches of the larger trees were similarly affected, while the large amount of honey dew excreted by the insects was responsible for a great quantity of black fungus, probably *Fumago vagens*, which covered the boles and leaves of the trees with a dense, black, sooty envelope. It was quite impossible to walk through a plantation without one's clothes being stained with the dark-coloured juice of the female sac, which was exuded whenever a sac was touched or brushed against. On all

sides the trees, both large and small, were dying in large numbers. Those trees which were not actually killed by the millions of little pumps that were sucking out the life sap of the trees, were greatly weakened, and the lack of sap in the tissues had the effect of cracking the bark in an abnormal manner. Thus the frosts of the winter were able to complete the destruction wrought by the scale. Large numbers of the trees were thus winter-killed, a condition that would not have been present had not the scale been at work. In plantations that had been badly affected, the tall gaunt dead boles of the trees were the only sight that met the eye. The only use that these dead trees could be put to was for firewood, as numerous wood fungi soon put in an appearance, and rendered the timber valueless for fencing and scaffolding purposes."

The round Black Scale (*Aspidiotus Rossi*), a very common native pest, has not so far attacked fruit trees, Olives excepted. This scale has a singular life history, as I have found it on the well-known pine-leaved native shrub (*Ricinocarpus pinifolius*), a plant belonging to the *Euphorbiaceæ*, which one would imagine to be palatable to insects of any kind. A singular fact, which was first brought under the notice of Mr. Maskell by me, was its ability to adapt its shape to the food plant upon which it was subsisting. On one occasion I found it upon *Ricinocarpus*, and its altered form exactly fitted the wire-shaped stem and branches of the plant, so that the scales, instead of being nearly round, as in the normal state, were of a long, narrow, oval shape, and of the same colour as the leaf stems, viz., of a reddish colour. This singular fact in the life history of *A. Rossi* is recorded in the *Transactions of the New Zealand Institute*.

Prevention and Remedies.

In Victoria, the bush fires, although terrible in their visitations, are the chief cause of keeping this formidable pest in check, as the flames sweep rapidly through the

undergrowth of gum saplings, killing out all badly-infested plants, together with the scale attacking them. Large trees of Messmate, Stringybark, and Peppermint, on account of the loose stringy nature of their bark, suffer severely; but generally those of the smooth bark kinds, such as the Blue Gum and the Giant Gum, escape with a severe scorching, and in most cases will be but little the worse for the fiery ordeal through which they have passed. This is shown by the enormous size of some of our monarchs of the forest, which, if they had been greatly affected by the periodical fires of many years, would have long since perished.

Where plantations are contemplated, a sharp watch should be kept for the first indications of the presence of this scale, as it increases with an almost incredible rapidity. In small places, a few sprayings with a strong kerosene emulsion will usually be effective; but where the scale has obtained a good footing and densely encloses the branches, it will be found that the usual chemical treatment will be of very little use. All seedlings before being planted should be examined by an expert who has an eye trained for the work, and any plant showing the least sign of being affected should be rejected and burnt.

In New Zealand, Mr. Kirk says that, since the initial distribution of the *Rhizobius* beetle, the work accomplished by this insect is little short of marvellous, and through its means *Eriococcus* has been relegated to a position of insignificance in the gum plantations of the south. In all parts of the affected area the scale is being rapidly eaten out, and around Timaru, the original centre of infection, it has entirely disappeared, the rapidity with which *Rhizobius* has multiplied being almost incredible. In January of 1908, his assistant collected over 1,300 scales on ten gum trees at Rolleston in a little over three hours. Thus the numbers in a large plantation are almost beyond the imagination. "In Australia, the balance of power is even

between the ladybird and the blight, and both of them are always present ; but in New Zealand the ladybird, being as it were in pure cultures and undisturbed by the presence of any secondary parasites, is much more powerful than the scale, and it completely wipes out the latter. It is not too much to say that within another twelve months there will scarcely be a living scale found on the southern plantations, which only three years ago were swarming with the pest, and to all appearances doomed to utter destruction."

The above is a most satisfactory state of affairs so far as New Zealand is concerned, but in Australia the conditions are, of course, very different, as in most of our Victorian forests, at any rate, Gum Trees (*Eucalypts*) largely predominate, and in some parts of the State the arboreal vegetation is composed of but very little else ; whereas in New Zealand the number of *Eucalypts* is very limited, and are, of course, introduced from Australia and Tasmania. So it happens that, although both the *Rhizobius* and *Crypolæmus* are indigenous to the State, the close proximity of our plantations to infested forests considerably reduces the valuable work of these parasites.

The plate shows nearly the whole life history of this pest, together with some of the parasites, especially the valuable little beetle *Orcus*, also cocoon of Scale-destroying Moth, *Thalpochares*. Many years ago, a friend and myself conceived the idea that the cochineal-like dye from these insects might be put to some commercial use, but the advent of the aniline dyes quite upset our well-intended project. Upon examining a badly-infested gum branch, especially when the same has grown in a natural forest, large quantities of the sacs will be found to have been quite destroyed by parasites of many kinds, but it is evident to any unprejudiced person that in Victoria, at any rate, parasites are no match for the scale, although the former help materially in keeping it and other scales

somewhat in check. Fortunately, this pest has never been known to attack ordinary fruit trees, but too much dependence must not be placed on the present forbearance of this formidable insect.

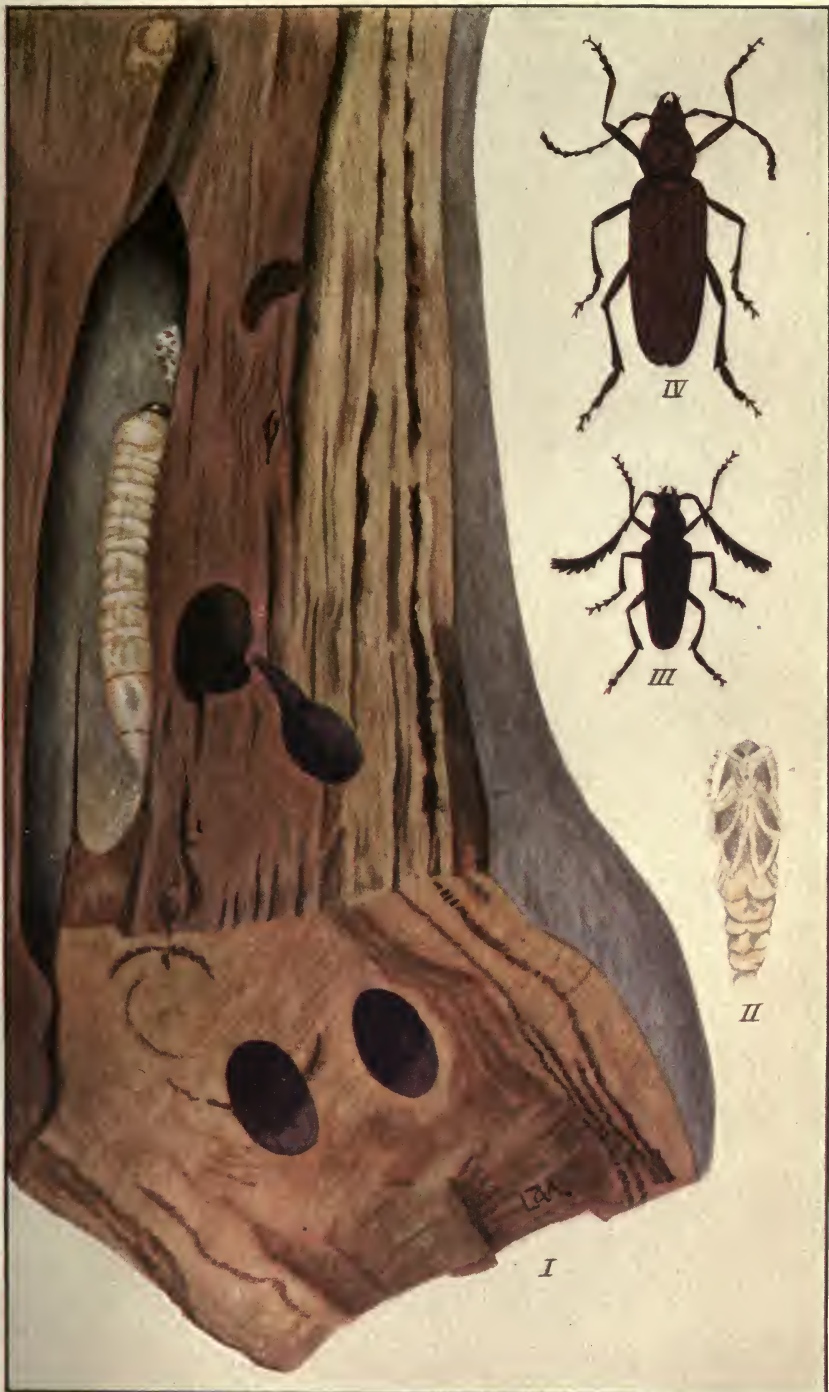
The Eucalyptus scale under notice is found over nearly the whole of Australia, and, as stated, is subject to the attacks of several parasites.

PLATE CXVII.

“ FEATHERY-HORNED YELLOW-BOX BORER ” (DISTICHOCERA
MACLEAYI, NEWMAN).

Fig.

- I. Portion of wood of Yellow-box (*Eucalyptus melliodora*), showing larva at work. From nature.
- II. Pupa. Natural size. From nature.
- III. Perfect Insect (Male). Natural size. From nature.
- IV. Perfect Insect (Female). Natural size. From nature.



CHAPTER CXXIII.

FEATHERY-HORNED YELLOW-BOX BORER.

(*Distichocera Macleayi*, Newman.)

Order : *Coleoptera*. Family : *Cerambycidae*.

This is a very handsome beetle, the larvæ of which feed on the wood of the Yellow Box, and frequently also on the wood of the White Gum (*E. Stuartiana*). The eggs are deposited either upon or in crevices of the bark, and, when hatched, commence to feed and bore into the wood. It is quite certain, however, that the breeding place of this insect is not confined to the two trees mentioned, as it has been taken where neither of these two *Eucalypts* is known to grow. The larva is of a dull, yellowish-white colour, and somewhat unusually tapers slightly at the extreme end. The female (see Fig. IV.) is reddish-brown in colour, and altogether a much larger insect than the male, which is black, with beautiful feather-like antennæ (see Fig. III.). The pupa, which is shown on Fig. II., is soft and mummy-like, but is soon hardened on exposure to the weather.

In Victoria, at least, this destructive beetle is considered somewhat of a rarity, but in reality, and as the timber shows, it is but too plentiful. The reason of its apparent rarity is that as soon as the beetles are sufficiently strong to crawl they ascend to the tops of the trees. It is supposed that this beetle is a night-flier, but both sexes have been frequently found feeding in the flowers of the *Leptospermum* bushes, especially on very hot days. In some parts of New South Wales it appears to be more commonly met with, and, although it is so destructive, it is eagerly

sought after by collectors. The genus is an Australian one, and comprises a fair number of species, nearly all of which, in the summer, frequent the flowers of *Bursaria*, *Leptospermum*, &c.

Prevention and Remedies.

I am indebted to Mr. Giles, late of Nar-nar-goon, Victoria, for having first brought the breeding place of this beetle under my notice, he having reared them from the Yellow Box, also from the stunted plant of *E. Stuartiana* growing in the vicinity. It would appear that saplings are seldom attacked, and, although there are many orchards in the district, it has never so far been known to attack fruit trees. In forests, all the dead and dying branches should, where possible, be sawn away and burnt, so as to kill any larvæ or beetles which may be in the affected wood ; the grubs remain for a long time in the wood before they reach the perfect stage, and, as both the male and female are strong fliers, they may soon spread to distant plantations.

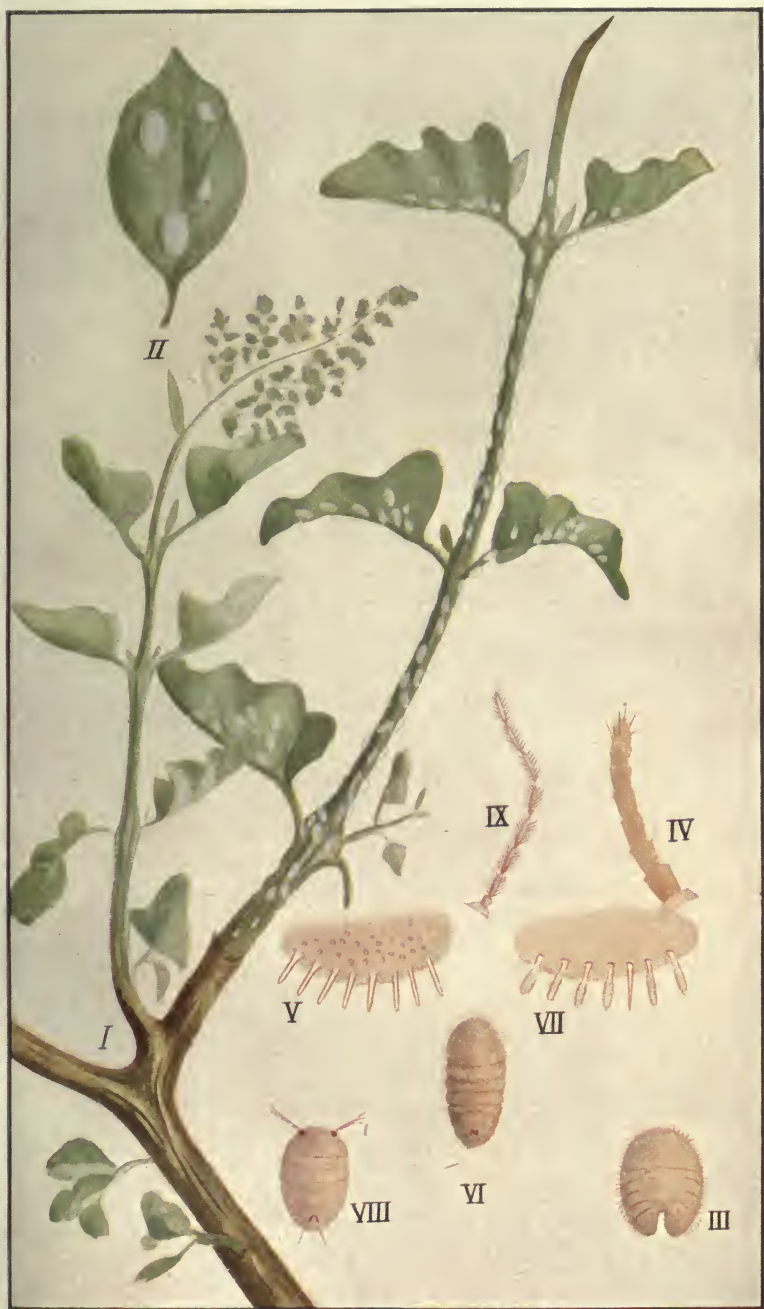
This beetle is also found in New South Wales, and, occasionally, in the Southern parts of Queensland.

PLATE CXVIII.

“SALTBUSH SCALE” (*PULVINARIA MASKELLI*, OLLIFF).

Fig.

1. Twig of Saltbush (*Atriplex*), showing scales. Natural size. From nature.
2. Leaf of Saltbush, showing scales. Magnified. From nature.
3. Adult Female, dorsal view before gestation. Magnified. After Maskell.
4. Antenna of Female. Magnified. After Maskell.
5. Marginal spines of Adult Female. Magnified. After Maskell.
6. Female of second stage. Magnified. After Maskell.
7. Marginal spines and fringe of Female (second stage). Magnified. After Maskell.
8. Larva. Magnified. After Maskell.
9. Antenna of Male. Magnified. After Maskell.



C. C. Brittlebank, Del.

C. French, Direxit.

Osboldstone & Co., Print.

Plate CXVIII.

CHAPTER CXXIV.

SALTBUSH SCALE.

(*Pulvinaria Maskelli*, Olliff.)

Order : *Homoptera*. Family : *Coccidæ*.

This singular scale insect was first sent to me from Wentworth, New South Wales, where at the time it was making great havoc among the Saltbushes (*Atriplex*), and bade fair to wipe out these valuable fodder plants of the squatter and grazier. The first known specimens submitted for scientific investigation were sent by myself to my friend, the late Mr. Maskell, who at the time was our leading specialist on scale insects. Mr. Maskell was at work on Australian *Coccidæ*, and found the scale to be a new one of very peculiar features, and, after a careful examination, it was placed in the genus *Signoretia*, so named on account of the well-known writer on scale insects. The species name of *Atriplicis*, after the plants on which the insects were first discovered, was bestowed on it by the late Mr. Olliff, then Entomologist to the Department of Agriculture of New South Wales. On further critical examination, the genus *Signoretia* was in this case discarded by Mr. Maskell, and the name given by Olliff allowed to stand. Mr. Maskell also mentions a variety of this species which was sent to him by the late Mr. Fraser Crawford, of Adelaide, and also by myself, as having been found on the Murray Pines (*Frenela*), and this insect has been named as a variety (*spinosa*).

When I first received the specimens from Wentworth, they were described as rapidly destroying the saltbushes in that and the outlying districts. As this scale is of so

destructive a nature, and owing to the close proximity of Wentworth to Mildura and other of our Murray districts, the pest is not unlikely to cross the river into our State.

The report of the late Mr. Olliff, who was sent by his Department on a special mission to the infested districts, at which places he collected some most important facts connected with the life history of the insect under notice, is interesting.

He says :—“ The scale insect here figured has recently been found doing an immense amount of damage to the various kinds of saltbushes, particularly to the plants known as *Rhagodia hastata* and *Atriplex nummularia* at Wentworth, in the western district of New South Wales. Immense numbers of these valuable fodder plants have for some time been dying in this locality. An investigation that I made during the past month proved that the trouble was due to the presence of a large scale insect, which on subsequent examination was found to be a new species of *Pulvinaria*, a genus of Coccidæ, in which the adult females construct a conspicuous cottony covering for their eggs, technically called an oversac, at the period of gestation.

“ This insect was first observed and forwarded to Sydney by Mr. D. A. Morgan, Inspector of Stock at Wentworth, and at the time of my visit the oversacs, each containing thousands of minute brownish-red eggs, were found in vast numbers on almost every saltbush, over large areas of country. Many of the bushes were literally covered with the scale, and appeared when viewed from a distance as if they had in some unaccountable way burst in masses of intense white flowers. On one small plant alone I counted more than sixteen thousand of these oversacs, a number that must indicate an almost incalculable quantity of eggs.

“ The fully-grown female is an active naked insect, measuring less than a quarter of an inch in length, and it is not until the insect fixes itself firmly to a twig of its food

plant for the purpose of laying its eggs that the cottony oversac is developed. This cottony or waxy scale completely envelops the eggs, which are further protected by the dead and dry body of the mother scale, which forms a sort of cap to the oversac, remaining firmly attached to its lower end. In this respect the Saltbush Scale resembles the well-known Fluted or Cottony Cushion Scale (*Icerya purchasi*), although the two insects belong to separate genera that differ greatly in structure and habits. In September, the eggs of the *Pulvinaria* or Saltbush Scale were beginning to hatch between the cottony sacs, and the young larvæ, minute, active, six-legged creatures, with six-jointed antennæ, and two long anal setæ, soon make their way to the young and tender shoots of their food plant."

Prevention and Remedies.

As this pest will most likely reach our State through the agency of birds and other means, it behoves us to be careful. The plants growing on the Victorian side of the river should be occasionally examined, and the matter at once reported if any outbreak should occur.

Under the conditions in which this pest seems to thrive best, it would appear that, owing to the large areas affected, the ordinary treatment, spraying with a deterrent or a remedial mixture, is practically out of the question. It is therefore advisable to await the advent of natural enemies in sufficient quantities and at the proper time.

The best way would be to pull up and burn as many of the affected plants as possible, as the increase of these insects is so rapid that one badly-infested plant will speedily insure the immediate infestation of all plants growing in the vicinity. As Mr. Olliff remarks, "One thing cannot be insisted on too strongly, and that is the absolute necessity for immediate destruction of the pest wherever it is found in limited patches. I venture to think that this

a duty which every grazier owes to his neighbour as well as to himself, for, when the scale makes its appearance on a run for the first time, no trouble or expense should be spared until it is stamped out."

There is no doubt that on isolated patches a non-poisonous spray, such as kerosene emulsion, might be used with much advantage, and in some cases the same treatment would be cheap and effective when used as a deterrent. Those of us who know the graziers' stand-by in the summer, the Saltbush, will appreciate the advice as to immediate action being taken so as to prevent, if possible, the pest from getting a foothold on their properties.

PLATE CXIX.

“ SILKY OAK WEEVIL BORER ” (*ÆSIOTES NOTABILIS*, PASCOE).

Fig.

- I. Portion of bark attacked, outside view. From nature.
- II. Portion of bark, underside view, showing fibre bitten off and placed around holes. From nature.
- III. Wood, with hole and covered bores. From nature.
- IV. Perfect Beetle. Natural size. From nature.
- V. Perfect Beetle, resting position. Natural size. From nature.
- VI. Head of Beetle, side view. Natural size. From nature.
- VII. Larva. From nature.



L. C. Vald. Andersen, Del.

C. French, Direxit.

Osboldstone & Co, Print.

Plate CXIX.

CHAPTER CXXV.

SILKY OAK WEEVIL BORER.

*(Æsiotes notabilis, Pascoe.)*Order: *Coleoptera*. Family: *Curculionidæ*.

This is a very handsome but destructive beetle, first found in Southern Queensland, and described by the late Mr. Pascoe in 1865. In Master's *Catalogue of Australian Coleoptera*, two other species of this genus are listed, one being a native of Victoria. Fig. IV. shows the beetle in its natural size, and Fig. VII. the larva; I regret being unable to include the pupæ, as we were unable to obtain specimens, although both larvæ and the beetles were in quantities.

This pest was first brought under my notice by my Assistant, Mr. C. French, jun., who describes the working as follows:—"These weevils are found in logs of Silky Oak (*Grevillea robusta*) and in Queensland Kauri (*Damara*) logs imported into Victoria from Queensland. The eggs are deposited in the bark, and when the larvæ hatch they at once commence to bore through the bark into the hard wood, where they remain for some considerable time. They eat out a hole about 1 inch in depth, and cover it over with pieces of wood eaten out of the hole made. Fig. III. shows a hole covered with the eaten wood, and Fig. I. a hole after the timber has been removed. Fig. II. shows where the insects, when fully grown, have eaten their way out of the cocoon-like covering, and Fig. III. the bark where the beetles had come through when they were fully grown. Most of the imported timber referred to goes to the Newport Railway Workshops, where, owing to

the prevalence of wood-boring insects, all timber is carefully inspected. Should any be found, the timber is treated with various chemicals."

It may with safety be asserted that the depredations of this beetle will not be confined to the two valuable timbers in question, so we cannot be too careful. Of late years, the Silky Oak has come into great prominence for furniture, fittings, picture-frames, &c. With proper protection, and with judicious selection, this tree should be one of the most valuable timber assets of the Commonwealth.

Prevention and Remedies.

All timbers coming into Victoria should be critically examined by an entomological expert. Where valuable timbers, say for carriage building and for the better class of furniture, are imported, these should be strictly quarantined in suitable buildings, detached, if possible, from factories and carpenters' shops. Chemical treatment of affected timber, if it is to be effectual, must be done very carefully, and at such intervals as would be justified by circumstances. Fortunately, this beetle is not difficult of detection; but as the newly-hatched larvæ may be at work inside and out of sight, it follows that it would require a trained eye to detect the trouble.

It would also be advisable for the timber to be examined by a competent person at the port of shipment, as the use of affected timber may lead to most serious results.

PLATE CXX.

"GREATER VINE SCALE" (*LECANIUM BERBERIDIS*, SCH.).

Fig.

- I. Vine branch, showing scale at work. Natural size. From nature.
- II. Female scale. Natural size. From nature.
- III. Female scale, anal portion. Enlarged. From nature.



CHAPTER CXXVI.

GREATER VINE SCALE.

*(Lecanium berberidis, Sch.)*Order: *Hemiptera*. Family: *Coccidæ*.

This formidable pest of the vine, the largest of the hard-shelled scales I know of, was first brought under my notice by the late Mr. George Neilson, the well-known horticulturist and fruit expert, and was found by him on some vines growing at Hawthorn, Victoria. Heroic measures were at once resorted to; the tree was hard-pruned, the cuttings burned, and the remaining portion of the plant sprayed with hot resin compound and a strong kerosene emulsion. This severe treatment evidently had the effect of arresting for the time the spread of this gigantic scale, but its presence was soon reported from other localities.

It would be interesting to know by what means it was introduced into our State; as in all viticultural matters the greatest care has been taken, it could hardly have been through the agency of vines or their cuttings. It is now well known that this scale is not restricted to vines, and it has been found on shrubs and climbing plants of several kinds, but, so far as I am aware, not on fruit trees. Judging from the specific name of this pest, the "Barberry" (*Berberis*) must have been its host plant, but of this I am not certain.

That this scale is on the increase there is no doubt, but as it is so large it is easily seen, and steps can at once be taken for its eradication.

Prevention and Remedies.

If the large scales are lifted up with the edge of a pen-knife, it will be observed that numbers of tiny, soft insects are moving about underneath the tortoise-shaped shell of the female scale. This is the time to attack them with the spray pump. Cut away and burn as much of the old wood as possible, and then with a brush well scrub the stem with hot kerosene emulsion—one part of the emulsion to five parts of water. Spray the weaker portions of the plant with kerosene emulsion—one part of the emulsion to ten of water. Clear away the soil from the base of the stem, scrape off and burn all old loose bark, and spread a little lime on the ground close round the stem.

This pest can be got rid of more easily than many others of the same group, but it must be watched, as also must shrubs and climbers growing in the same garden. When treating vines, be careful that any insects clustering round the newly-cut branches are at once destroyed, as when first hatched the young scale are somewhat difficult of detection, and may have to be carefully looked for.

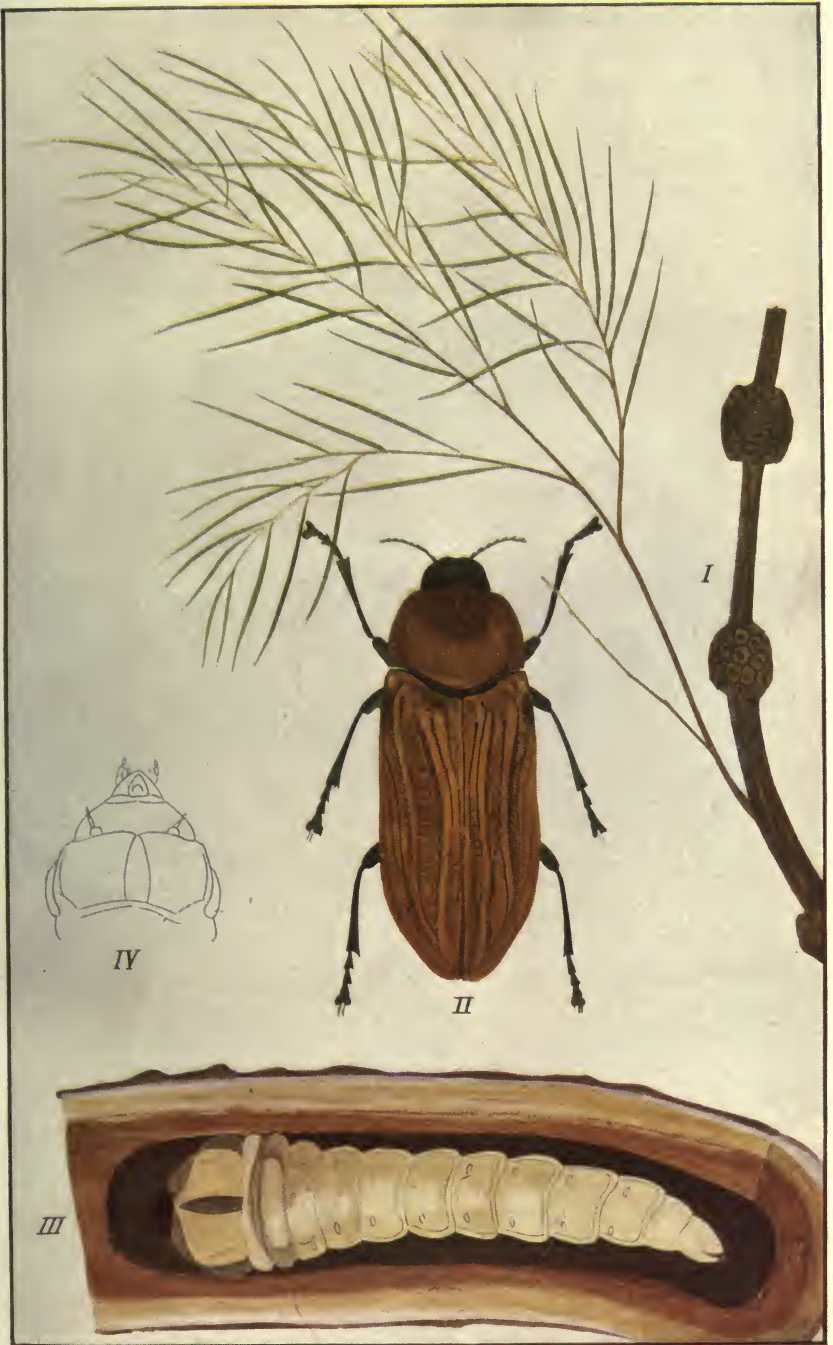
Parasites, small wasps, &c., have been seen hovering about scale-infested vines ; but these must not be waited for. A good spray pump will save the situation.

PLATE CXXI.

“SHE-OAK ROOT BORER” (STIGMODERA HEROS, GEHIN.).

Fig.

- I. Tea Tree (*Melaleuca uncinata*). Natural size. From nature.
- II. Perfect Insect. Natural size. From nature.
- III. Larva. Natural size. From nature.
- IV. Head of larva, showing mandibles. Natural size. From nature.



C. C. Brittlebank, Del.

C. French, Direxit.

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Plate CXXI.

CHAPTER CXXVII.

SHE-OAK ROOT BORER.

*(Stigmodera heros, Gehin.)*Order: *Coleoptera*. Family, *Buprestidæ*.

This formidable insect, which is the largest of the Victorian *Buprestid* beetles, is most destructive to various kinds of timber growing mostly in the northern and north-western portions of the State. It is also found in South and Western Australia. The larva feeds in She-oak and Bull-oak (*Casuarina*), and frequently in the *Eucalypts* growing in or near the Mallee country.

The larvæ of these beetles are large yellowish white grubs, with powerful jaws, the female beetle being much larger than the male. The female clears spaces in the butts of trees and deposits her eggs, which are somewhat lighter in colour than the grub, on the side of the trees. When hatched, the young larvæ at once commence to eat their way into the wood of the tree attacked. After working downwards to a depth sometimes of several feet, the larvæ bore and tunnel into the wood, the sawdust of which serves as food for the grubs. Judging from the quantity of excreta formed, and from other indications, it would appear that in many cases the larval stage lasts as much as two years, or even more. It is suspected that, in comparison, the pupal stage is of short duration. When the perfect insect emerges into a large yellowish-brown beetle, it may be found in large numbers feeding in the flowers of the stunted Mallee, also in the *Melaleuca*, a twig of which, together with the beetle, is reproduced.

When fully developed, the larvæ of these beetles have small but very powerful mandibles or jaws, and with these they can gnaw almost any kind of timber, no matter how hard it may be.

These beetles, like many others of the group, would appear to be very intermittent in their escape from the wood, as one year they simply swarm, and the next season of the same climatic conditions hardly a specimen is to be seen. There are other large kinds of this genus (*Stigmodera*) to be found in Victoria, the largest being *S. bakewelli*, *S. fornumi*, *S. vitticollis*, and *S. parvicollis*. These, no doubt, do immense damage in the forests.

It has long been suspected that there are two large species of this genus very much alike which have hitherto passed for the species, *S. heros*, now under notice. This question, which to naturalists would be of great interest, has not yet been definitely decided.

It is unfortunate that so far we have no reliable information as to this beetle attacking fruit trees, but as so many other insects have left their native food trees to attack fruit trees, we cannot be too careful. It may be easily imagined what damage to fruit trees this beetle would cause.

There are about 800 described species of the family to which this insect belongs.

Prevention and Remedies.

In forest lands, the only practical way of dealing with this pest would be to kill as many as possible of the beetles in order to prevent egg-laying. Where there are but a few trees to protect, this might be done by smearing the usual egg-depositing places with such materials as tar and grease mixed together.

It is advisable to capture as many of the females as possible, as they deposit a large number of eggs. They can be caught in a net, and destroyed by scalding.

It has been observed that in nearly every one of the larger ants' nests in certain localities in the Mallee the wing-cases and other remains of these large beetles may be found.

PLATE CXXII.

“GUM-TREE MOTH” (*RÆSELIA LUGENS*, WALKER).

Fig.

- I. Gum (*Eucalyptus*) leaf, showing larva at work. Natural size.
From nature.
- II. Pupa and covering. Natural size. From nature.
- III. Pupa. Natural size. From nature.
- IV. Perfect Insect (Male). Natural size. From nature.
- V. Perfect Insect (Female). Natural size. From nature.
- VI. Leaf, as abandoned by larvæ. Natural size. From nature.



L. C. Vald. Andersen, Del.

C. French, Direxit.
Plate CXXII.

Osboldstone & Co., Print.

CHAPTER CXXVIII.

GUM-TREE MOTH.

*(Ræselia lugens, Walker.)*Order : *Lepidoptera*. Family : *Arctiidae*.

This moth is of a small brownish-grey colour, and is of the size of Figs. IV. and V. of our plate. The eggs are deposited on the leaves of the gum trees, especially those growing in plantations. When hatched, the young larvæ begin to feed, and, as they increase in size, they do an almost incredible amount of damage to the trees themselves. Fig. I. shows the manner in which the epidermis or outer covering of the leaves is eaten, and if the grubs be not killed a few strippings will usually complete the destruction of at least the upper portions of the tree attacked. This pest is particularly numerous in the plantations near Sunbury and elsewhere, and is perhaps the worst of all the smaller insect pests of our gum trees. It was formerly known by the name of *Nola lugens*, and is an old enemy of the gum trees. In some parts of the State, the tops of the *Eucalypts* appear from a distance as though a fire had passed through them.

The larvæ of the Cup Moth are also very destructive in this respect. Some new facts regarding the Cup Moth have lately been investigated by my Branch. It was found that the water supply of an important country district was becoming black, and unfit for use. On investigating the matter, it was found that on the foliage of the *Eucalypts* growing near and hanging over the race were hundreds of grubs of the Cup Moth, whose excreta had badly fouled the water. The cause was previously ascribed to the dredging up-stream. Mr. French, jun.,

advised that the trees should be chopped down on both sides of the race, and this precaution will no doubt prevent a repetition of the trouble.

This moth is also found in several of the other States, and is everywhere a serious pest. Mr. French, jun., remarks that around Melbourne numbers of the pupæ of this moth are destroyed by small *Hymenopterous* insects.

Prevention and Remedies.

Fortunately, these grubs are amenable to treatment. In plantations, a good deal may be done by constantly watching the young trees and spraying with kerosene or red oil, one in fifteen, as a deterrent, and, as the insects seem to favour saplings, the application would be neither costly or difficult. If it should be found that the grubs have commenced their work of stripping the leaves, a few sprays, either of Paris green or arsenate of lead, will soon kill them. It may be said that to spray a forest would be out of the question. Spraying a forest is not recommended, only the embryo forest, the plantation, which if left to itself will in all probability never reach the forest stage for which it was intended. It is hard to induce some people to credit the enormous damage done to forests by insects.

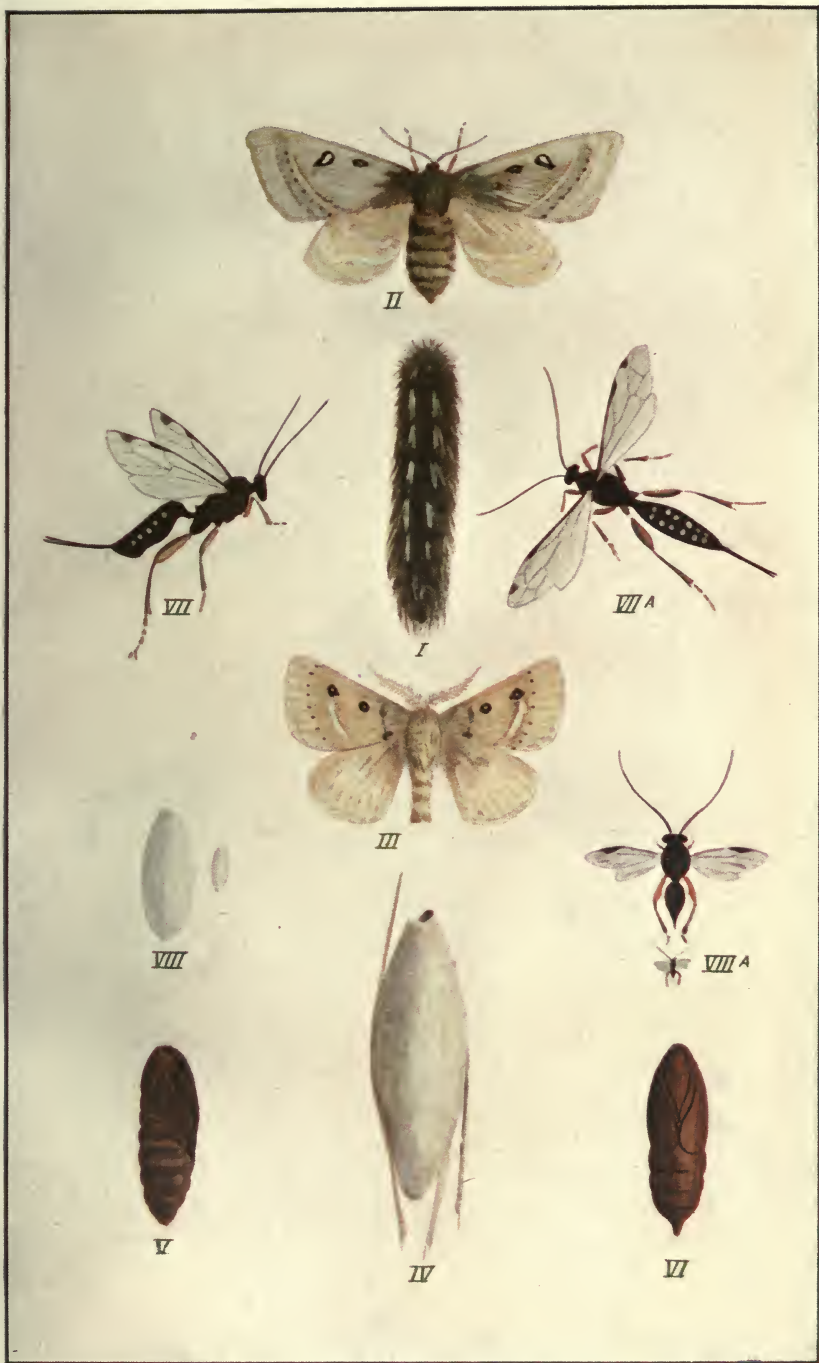
If forestry is to take its proper place as an industry in Victoria, the study of forest pests should be one of the principal subjects in the curriculum of a school of forestry.

PLATE CXXIII.

“COMMON DARALA MOTH” (*DARALA OCELLATA*, WALKER).

Fig.

- I. Larva. Natural size. From nature.
- II. Perfect Insect (Female). Natural size. From nature.
- III. Perfect Insect (Male). Natural size. From nature.
- IV. Puparium. Natural size. From nature.
- V. Pupæ. Natural size. From nature.
- VI. Pupæ. Natural size. From nature.
- VII. Ichneumon Fly Parasite. Natural size. From nature.
- VIIA. Ichneumon Fly Parasite. Natural size. From nature.
- VIII. Cocoon of Ichneumon Fly Parasite. Natural size and magnified.
From nature.
- VIIIA. Ichneumon Fly Parasite. Natural size and magnified. From
nature.



CHAPTER CXXIX.

COMMON DARALA MOTH.

*(Darala ocellata, Walker.)*Order : *Lepidoptera*. Family : *Liparidæ*.

This is a very common and most destructive pest. The various figures on the plate show the life history, together with some *Hymenopterous* parasites, which we have reared both from the cocoons and the caterpillars. In late spring, the caterpillars may be seen in thousands, and they appear to travel in the one direction, eating up such plants as are fancied by them. They are especially destructive to grasses on pasture land, as they eat the grass as well as defile the pastures when they are numerous.

Mr. Anderson remarks :—" There is a great difference in the life history of the two (alluding to the Striped Darala, *D. denticulata*), for, whereas the Striped Darala takes a whole year to complete its metamorphosis, the Common Darala gets through two generations in the same space of time ; the first are found feeding from June to September, the moths appearing in November. Caterpillars from these may be found during December and January, and the resulting moths are on the wing in March and April."

The habits of the two species are similar, but the common *Darala* does not construct such an interesting cocoon as its congener. These moths are brown, marked with different shades of the same colour, and have two distinct black spots in the centre of the forewing. The male has the antennæ plumed (Fig. III.), while in the female they are simple (Fig. II.).

The genus *Darala* is very liable to attacks by Ichneumons and by closely-allied insects, and, although partly immune from the attacks of most birds, both insect and fungus parasites assist materially in checking the pest. This genus is peculiar to Australia, and is allied to the well-known Gipsy Moth of Europe, a pest which has been introduced into the United States, and in endeavours to cope with it huge sums of money have been spent.

Prevention and Remedies.

As with other insect pests, cleanliness in cultivation is absolutely necessary. This gets rid of all spots suitable for egg-laying, and prevents wholesale hibernation. In the summer time it is no uncommon sight to see these grubs travelling across dusty roads; as the dust accumulates on their hairy bodies, they appear much larger than they really are. Immense numbers of them may be destroyed by drawing brush harrows or rollers quickly over them, also by the use of drains or pits dug perpendicularly across their line of travel. This plan is a good one to adopt against travelling caterpillars of all kinds, and is a sure and inexpensive method of dealing with the pest in the travelling and grub stage.

There are much larger species of *Darala* in Victoria and other parts of Australia, but these do not appear to be so numerous as the one under notice. Previous remarks as to trapping and poisoning the larvæ will apply equally well to these species.

PLATE CXXIV.

“SPINED LOG BEETLE” (*XENOCNEMA SPINIPES*, WALL.; VARIETY
AUSTRALIÆ, LEA).

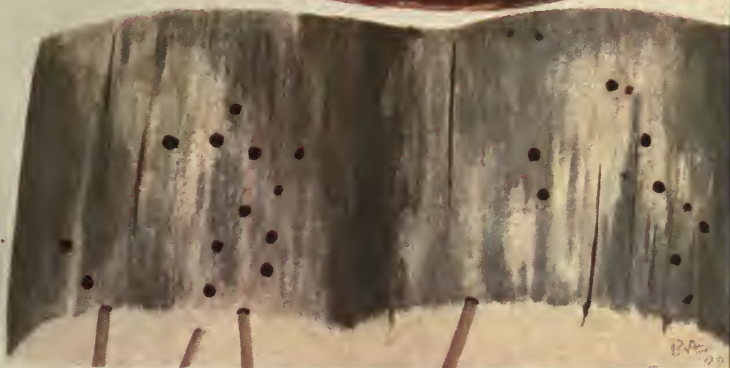
Fig.

- I. Bark and wood, inside view, showing tunnelling by larvæ and holes bored by Beetles. Natural size. From nature.
- II. Wood perforated by Beetles. Natural size. From nature.
- III. Perfect Insect (Female). Enlarged. From nature.
- IV. Perfect Insect (Male). Enlarged. From nature.
- V. Perfect Insect (Female). Natural size. From nature.
- VI. Perfect Insect (Male). Natural size. From nature.
- VII. Larva. Natural size. From nature.

I.



II.



V. VI. VII.



III.

III.

CHAPTER CXXX.

SPINED LOG BEETLE.

(*Xenocnema spinipes*, Wall.; variety *Australiæ*, Lea.)

Order: *Coleoptera*. Family: *Curculionidæ*.

This is a small brownish-black beetle determined by Mr. Lea as a new variety of a well-known weevil, described long since by Wallach. It is found plentifully under the bark of Kauri and Silky Oak logs from Queensland. The beetles bore through the bark into the solid wood, and under some pieces of bark the beetles may be found in large numbers; upon removal of the bark they commence boring at a rapid rate, and soon have the wood riddled with holes. Fig. II. shows the holes, and Fig. I. the tunnels with the larvæ at work inside.

This is another instance, if such were required, of the necessity of being constantly on the look-out for these dangerous insect introductions; more especially as they increase with great rapidity, and, if once established here, it would be almost a hopeless task to attempt to permanently eradicate them. Numbers of these small weevils—which, by the way, are legion—comprise some of the very worst of our timber borers, and, although so small in size, they appear to be able to bore through all timbers, no matter how hard the latter may be. It is a singular fact in the economy of Nature that the tiniest insect frequently does the most damage, as witness the ravages of *Phylloxera* and other minute insects.

We have shown the beetles in their natural size and also enlarged, but at the time the plate was drawn the pupa could not be obtained. It will, however, be somewhat like the larva in colour, with the mummy-like appearance of the beetle before the latter assumes the perfect shape.

Few people, excepting those in the trade, are aware of the enormous loss of timber caused by insect pests. When a pest gets a footing, hardly any timber is safe from its attacks. Building material and furniture are liable to attack and possibly destruction from the pests. As an instance, I may mention that a small imported beetle (*Lictus brunneus*) will work nearly as quickly in the Oak, Walnut, or Rosewood of a piano as it will in an ordinary piece of pine timber.

Prevention and Remedies.

The remedies against this and similar pests are in our own hands, and consist in keeping a vigilant watch on all importations of timber, especially when in logs, no matter where they may have come from. Now that the shippers have been advised to remove the bark before sending away the logs, it has been found that recent shipments have shown signs of much improvement on lots previously examined at the port of Melbourne or on the wharfs. All logs coming here are inspected, and if found to be affected by weevils or other insect pests, they are treated under the immediate supervision of an inspector.

1. The American Medical Association is a non-profit corporation organized for the purpose of promoting the interests of the medical profession and the public health.

2. The Association is organized into a national body and into state and local branches.

3. The Association is organized into a national body and into state and local branches.

PLATE CXXV.

“GREYISH-HORNED BEETLE OF THE WATTLE.” (*PACHYDISSUS*
SERICUS, NEWMAN).

Fig.

- I. Section of stem of Black Wattle, showing holes bored by grubs of Beetle. Natural size. From nature.
- II. Larva or grub in timber. Natural size. From nature.
- III. Perfect Insect (Male). Natural size. From nature.
- IV. Perfect Insect (Female). Natural size. From nature.
- V. Pupa. Natural size. From nature.



L. C. Vald, Andersen, Del.

C. French, Direxit.

Osboldstone & Co., Print.

Plate CXXV.

CHAPTER CXXXI.

GREYISH-HORNED BEETLE OF THE WATTLE.

(*Pachydissus sericus*, Newman.)

Order : *Coleoptera*. Family : *Cerambycidae*.

This is a brown Longicorn (long-horned) beetle, with a silvery sheen—a colour very difficult to show correctly in a drawing. This species is very common in many parts of our State, and it has a wide geographical range. In Victoria, it feeds principally upon the wood of the common Black Wattle (*Acacia decurrens*), to the limbs of which it does great damage. The eggs are deposited by the female on the bark of the tree, and the larvæ, when hatched, at once commence to bore through the bark into the wood, where they remain for a long time ; how long is not known. Mr. Froggatt speaks of this pest doing damage to the limbs and branches of *A. longifolia*, but I have never seen this tree attacked by it, although very susceptible to the attentions of *Uracanthus* and other wood borers of the Longicorn family.

The male (Fig. III.) is smaller and narrower than the female, but nearly identical in colour to the latter (Fig. IV.). The mummy-like pupa (Fig. V.) is yellowish-white in colour, and the larva (Fig. II.) is about the same colour as the pupa.

Fig. I. shows a portion of a cross-section of the common Black Wattle, from which some of the insects illustrated were reared. It has always been a puzzle for me to account for the partiality which many beetles, also other orders and families of insects, have for the bark and wood of the wattle. It is a well-known fact to entomologists that very few

insects of any kind are found in the blooms of the common Black Wattle, or, in fact, upon very few others, "Mulga" perhaps excepted. In the early days of Victoria, an infusion of the bark of the Black Wattle was considered to be the only reliable remedy for dysentery, then so frequent in the colony that very few of the earlier settlers escaped its attacks. It might reasonably be supposed that the astringent nature of the bark would render this wattle, at any rate, partly immune from insect attack, but the reverse is the case, as the wattle has more insect enemies than even the *Eucalypts*.

A case has recently come under notice of branches of Plum trees having been "cut off" and a great deal of damage done, and it is strongly suspected that one of the native Longicorn beetles may prove to be the culprit. This is a matter which will be carefully investigated, as, although this beetle has never yet been known to attack orchard trees, there is a possibility of its doing so.

The beetle is also found in New South Wales, Queensland, and South Australia. It is generally found under the loose and partly-dead bark of the wattle, which, as before mentioned, is also a favourite resort for other kinds of small beetles, such as *Ips*, &c., which feed on the decomposed sapwood and bark of the tree.

There are several species of this genus described as occurring in Australia; the well-known *Cerambyx*, which is a closely allied genus, is one of the most destructive timber borers in other countries.

Prevention and Remedies.

On plantations, a strict watch should be kept for the first appearance of the fine sawdust coming from the trees. When such appears, wires dipped in either bisulphide of carbon or carbolic acid should be at once used as previously recommended. Where branches

are affected, these should be cut away, if practicable, and burnt for the purpose of destroying the larvæ at work inside. Fortunately, however, the sawdust is a sure sign of trouble, and, unlike the workings of the White Ant, gives the key as to what is best to be done.

The injection of either bi-sulphide of carbon or carbolic acid can also be done by means of a small medical syringe in place of the wire referred to.

PLATE CXXVI.

“BOISDUVAL’S FIG-TREE BORER” (*BATOCERA BOISDUVALI*, HOPE).

Fig.

- I. Larva of Beetle. Natural size. From nature.
- II. Pupa (Female). Natural size. From nature.
- III. Pupa (Male). Natural size. From nature.
- IV. Perfect Insect. Natural size. From nature.

NOTE.—The perfect stage of this beetle has been drawn from a specimen in my own cabinet, whilst the larva and pupæ are from specimens which were kindly lent to me by Mr. Illidge, of Brisbane, Queensland.



IV.



II.



III.



I.

CHAPTER CXXXII.

BOISDUVAL'S FIG-TREE BORER.

(*Batocera Boisduvali*, Hope.)

Order: *Coleoptera*. Family: *Cerambycidae*.

This fine Longicorn beetle is a denizen of the great scrubs, now fast disappearing, of Northern New South Wales and South Queensland. Mr. Illidge, the well-known Brisbane entomologist, says, "It is only found upon the Giant Fig-trees (*Ficus macrophylla* and *F. australis*) growing in these vast forests." Healthy trees, he says, are not subject to its attacks, but the stems and larger branches of damaged and freshly-fallen trees are those selected by the female upon which to deposit its eggs. The grub, which we figure, upon emergence from the egg, burrows through and under the bark to the sap-wood, upon which it feeds, rapidly growing in size, and boring in deeper, until there is no visible sign of its presence upon removal of the bark.

In the following season, the greater number of the larvæ are ready for the change to the pupal stage (see Fig. II.), though a few still remain for a few months longer, and rarely for a second year in the larval state. The pupal stage is not of great duration, usually about three weeks or a month. No cocoon is formed, but a very carefully-made puparium is prepared by the grub before the change takes place. (Mr. Illidge speaks of having made false puparia for the grubs, after cutting them out of the wood, from suitable glass-topped metal boxes about 4 inches in diameter, lined with blotting-paper, and worked by the finger as nearly as possible to the form of the puparia.) In these glass-topped boxes the transformations

have been frequently watched, both to chrysalis and imago or perfect insect. The grub must, of course, be taken when ready for the change, and a little experience soon teaches, just as readily as to the silkworm rearer is indicated the time when the caterpillar is about to spin its cocoon.

In rearing these beetles in this way, there will be found a great tendency to dehiscence, *i.e.*, a splitting of the elytra or wing-cases. This can easily be remedied if the freshly emerged insect be taken while in the plastic state, and the end of the elytra gently pressed and squeezed together by the fingers. They require to be kept at least three months before they are properly hardened. When just captured, their markings vary from pale-yellow to orange; these colours, however, fade after death into a pale-cream colour, becoming almost white, as shown in Fig. IV. In the natural state, the great cutting power of their mandibles or jaws soon releases them from the puparium, which is seldom over an inch from the surface of the tunnel or branch.

Mr. Illidge speaks of this beetle as being confined to the native fig trees, but many years ago I received a specimen from the Clarence River, New South Wales. I was informed that the specimen sent had been cut out of the living cedar trees, and I have therefore included this pest, as large quantities of cedar logs are constantly arriving here from New South Wales and Queensland.

The large family of the Longicorn or long-horned beetles comprises some of the most destructive of boring insects, and, as before stated, it is necessary to carefully watch all oversea shipments of timber in logs, some of the worst of the American and European kinds of insects having been already found on our wharfs and in our timber yards. As an example of the danger of introducing borer in foreign timbers, I may mention a case which not long since happened at one of the wharfs on the Lower Yarra, when a European Longicorn beetle, *Clytus*, bored some

holes through the ship's deck, and some of the beetles were found partly emerged from the wood. In Australia, the Longicorn beetles number close on 1,500 species (I have over 1,000 species in my collection), and the whole are more or less destructive to forests, timbers in buildings, &c. The foreign kinds are even more numerous and quite as destructive as those of Australian origin.

Prevention and Remedies.

As we have before stated, the most stringent measures must be resorted to in trying to keep out this and similar pests which may be introduced, especially when the timber is in log form. All such consignments should be overhauled on arrival, and should not be allowed to lie about on the wharfs, as it is through the agency of imported timber that many of our furniture borers have been introduced. When these pests have once obtained a footing, eradication becomes a matter of supreme difficulty, if not an impossibility.

NOTE.—Since writing the description of this species, numerous cases of beetles attacking valuable furniture and house timbers have come under notice. In each instance the trouble has been traced to Japanese and Chinese verandah blinds or to bamboo furniture from the East. I would therefore strongly recommend that all imported cane, bamboo, and wicker-work furniture be treated for at least 24 hours with cyanide gas at the Government Fumigator on the wharf, before permission for removal is granted. The particular species of beetle responsible for the damage will be figured in Part VI. of this work.



L. C. Vald. Andersen, Del.

C. French, Direxit.

Osboldstone & Co., Print.

WHITE IBIS.

(Ibis Molucca, Cuvier.)

Plate CXXVII.

CHAPTER CXXXIII.

WHITE IBIS.

(*Ibis Molucca*, Cuvier.)

The White Ibis claims special notice. It is a noble bird, with the upper portion of the head naked, and of a dark bluish-black in colour, and, as our plate shows, some pinkish marks on the back of the neck. The White Ibis is slightly larger than the Straw-necked Ibis, with the bill rather more curved than the latter species. In height, when erect, it is about 22 inches, and is mostly to be found in swamp country, although I have frequently seen it on dry box country, and in company with the Straw-necked Ibis.

The Ibis is a voracious feeder, and the amount of the food which it consumes is, for the size of the bird, simply wonderful. Mr. Campbell, in his valuable book, *Nests and Eggs of Australian Birds*, gives some interesting particulars of a visit made by him, during a trip with Mr. Geo. Morton, the well-known Benjeroop naturalist, to the breeding-grounds of this fine species. The following is taken from the article in question :—

“We pole to deeper water in the centre of the swamp, towards a large growth of bulrushes. Approaching these, another wonderful revelation confronts us. The whole place is alive and croaking with Ibises of two species—the Straw-necked and the White. The dark-coated Straw-necked Ibises rise first, in companies of about half-hundreds, and fly away. The White species, evidently nesting, is reluctant to follow suit. But they are compelled to move when we shoot the prow of our boat into the rushes amongst their nests. The nests are picturesquely grouped on

irregular steps or terraces formed by the tops of the rushes being split or frayed out, then trampled or matted together to within a few inches of the water. Hastily looking at these nearest to us, we see a nest with five eggs, another with four, and four with three each. Out of the scores of nests on the rookery, only a few are occupied with helpless young birds, not many days old. Their heads are black, and the pinkish skin of the rest of their bodies shows strongly through a moderate coating of white down."

This bird is one of the best of our insect-destroying birds, and, like the White-fronted Heron (or Blue Crane of the colonists), it is very partial to the small shell hosts of the dreaded "fluke," and thus its great reputation as a useful bird is well preserved. Found also in Australia generally, also in the Molucca group and Papua.



L. C. Vald. Andersen, Del.

C. French Direxit.

Osboldstone & Co., Print.

STRAW-NECKED IBIS.

(*Carphibis spinicollis*, Reich.)

Plate CXXVIII.

CHAPTER CXXXIV.

STRAW-NECKED IBIS.

(*Carphibis spinicollis*, Reich.)

The Straw-necked Ibis I unhesitatingly place at the head of the list of the insect-destroying birds of Australia. Others who differ from me place the highly-valued White-fronted Heron or Blue Crane before it, but this matters but little, both birds being of the best. This fine bird is bare on the head and upper portions of the neck, with a singular appendage of straw-like feathers, hence its common name. The composition of these singular feathers gives it a most strange appearance, and quite unlike that of any other Australian bird. In height, when standing erect, it is about 20 inches, sometimes more. The colour of the wings is of a beautiful bluish bronze, somewhat difficult to describe, and more difficult still to reproduce faithfully. The legs are reddish, with a lighter colour towards the lower portion of the breast.

The Straw-necked Ibis frequently occurs in immense numbers, and Gould mentions that after the severe drought in 1839 he found this bird in such abundance on the Liverpool Plains, New South Wales, that to compute the number of birds in a single flock was simply impossible. In the North-eastern districts of Victoria, I have seen them in flocks of hundreds, and, in the grasshopper season, by thousands. They have a great appetite, and the number of hoppers and other insects which they will devour is beyond all attempt at calculation. As destroyers of crickets they are without a rival, save, perhaps, the White-fronted Heron before referred to.

The nests of these birds are usually placed in swampy Polygonum (*Muchlenbeckia*) bush country, and are very thickly placed and visited by these birds in enormous numbers. The eggs in a clutch usually number three or four, and sometimes five. Some splendid photographs of these rookeries have been taken by Messrs. Campbell, Mattingley, Le Souëf, and others, and are well worthy of reproduction.

It is pleasing to know that all species of these useful birds are now permanently protected. The Ibis should be encouraged wherever seen, and any violation of the game laws should be at once reported, and rigorously dealt with.

The Straw-necked Ibis is found in every State in Australia, also sparsely in Papua. A smaller and very elegant bird, known as the Glossy Ibis (*Plegadis falcinellus*), is also found in Australia. It is of beautiful glossy bronze-green colour, and is found in Papua, Malayan Archipelago to Asia, Europe, Africa, and a portion of North America.



L. C. Vald. Andersen, Del.

C. French, Direxit.

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WHITE-FRONTED HERON.

(*Notophox Novæ-hollandiæ*, Latham).

Plate CXXIX.

CHAPTER CXXXV.

WHITE-FRONTED HERON.

(*Notophox Novæ-hollandiæ*, Latham.)

This bird is bluish-grey in colour, with yellowish legs ; and less than three times the size of our figure. This fine bird is also one of the most useful, as, being a wader, it not only devours the shell host of the fluke, but is singularly fond of the destructive black, or field, cricket. The flight of this bird is somewhat heavy and unwieldy, the wings flapping lazily, and the long legs dangling from one side to the other.

The Blue Crane, another name for this bird, is very common in most parts of Victoria ; solitary examples, at any rate, may be seen near any piece of swampy country. They are not easily disturbed, and even then they fly away in a very leisurely manner.

The nests are built in the branches of trees, usually near a lake or swamp. Mr. Campbell describes the nest as "a platform, about 15 inches in diameter and $3\frac{1}{2}$ inches in height, composed of coarse sticks, with smaller sticks or twigs built into the centre ; the nest is much bespattered with lime, and frequently re-used. Eggs—clutch four to five, elliptical in shape, texture of shell somewhat coarse, surface slightly glassy ; colour, pale bluish-green, when the shade is exquisite for beauty." The breeding months are from September to January.

It has already been mentioned that this bird is a great destroyer of crickets, the latter being one of the greatest enemies of the grazier in Victoria. On my dissecting one of the birds, it was found to have swallowed no less a number than 346 of these crickets. In speaking of the

habits of this bird, Mr. R. Hall mentions having seen a flock of 57. This was on the 16th December, 1896, at Western Port, and he further says that he has observed their capacious stomachs crammed with grass-hoppers. Dr. Cobb speaks of them as fluke eaters while the animal is in its host (*Bulimus*), a fresh water mollusc. These birds are also great destroyers of yabbies, the lobster-shaped crustacean which does so much damage to our irrigation channels. Mr. Hall further remarks that in Victoria, during recent years, many species of freshwater snails which house the fluke have been discovered. The fluke finally leaves the snail, and goes on to the grass, and with the latter is eaten by the first sheep that comes along.

Unfortunately, this is one of those birds which are the victims of the "pot-shotter"; it rises so slowly that any one can shoot it. There is no excuse whatever for the killing of this useful bird, as it is simply a bundle of feathers, the body being very small for the size of the bird. The White-fronted Heron is frequently attacked by the Black-cheeked Falcon, and falls an easy prey to the savage little hawk.

The White-fronted Heron is found throughout the whole of Australia and Tasmania; also in New Zealand, Loyalty Islands, and New Caledonia, through Papua to the Molucca Islands and the Celebes Group.



C. French, Dixxit.

Osboldstone & Co., Print

AUSTRALIAN BUSTARD OR WILD TURKEY.

(*Eupodotis Australis*, J. E. Gray).

Plate CXXX.

CHAPTER CXXXVI.

— —

AUSTRALIAN BUSTARD OR WILD TURKEY.

(Eupodotis Australis, J. E. Gray.)

The Australian Bustard or Wild Turkey is a truly noble insect-destroying bird, which, unfortunately for our farmers and graziers, is fast disappearing from most parts of the State. The "pot-shotter" and the poison cart are largely the cause of its rapidly reducing numbers. In the early days of Victoria, this bird was fairly common, especially on the plains and open country in the North-western parts, but now it is threatened with partial if not total extinction.

The Wild Turkey, when fully grown, will stand nearly 3 feet 6 inches in height, and in colour is a dappled greyish-brown, legs yellowish. A good specimen has been known to weigh from 13 to 16 lbs. Gould, in his valuable handbook, says that "in size, this species exceeds the European Bustard (*Otis tarda*), standing higher upon its legs, and having a longer neck, and when seen at feed or slowly stalking over its native plains, no Australian bird, except the Emu and Cassowary, is so majestic, or assumes in its carriage so great an air of independence. The male is much larger than the female, and, from the greater length of the plumes of the neck and occiput, is much more stately in appearance. It flies heavily, with its long neck stretched out to the utmost, but is capable of sustaining flight for a considerable distance. The eggs of this fine bird are laid usually in clutches of two in number, and in such situations I have frequently come across them." Mr. Campbell and others speak of the nest being indicated by a few twigs, but, personally, I have not noticed this peculiarity.

The breeding months include June to November ; Gould says September, and Mr. Campbell quotes an instance when fresh eggs were found in Central Queensland in the middle of March.

The Wild Turkey is a most voracious feeder, and in the grass-hopper or locust season it is no uncommon sight to see some of the birds so gorged with the above-named insects as to be unable to rise from the ground ; in this condition they are frequently killed with sticks.

It is gratifying to know that these useful birds are now protected all the year round in Victoria, and it is to be hoped that any one found either killing the birds, or taking their eggs, will be severely dealt with. Some time since, it was no unusual occurrence to see a Wild Turkey hanging for sale outside City poulterers' shops ; and as the excuse was given that the birds were sent from New South Wales, it was difficult to sheet home the blame to the proper culprits. I therefore suggested that no person be permitted to have these birds in their possession, or to expose them for sale. This had the desired effect, and Victoria, at any rate, is free from the blame of destroying what, in reality, is one of the best insect-destroying birds known. This bird is still common in some of the drier parts of Australia, where, irrespective of its great value as a destroyer of insects, it is relentlessly hunted and eaten, although it requires to be specially cooked, after the method of treating game. The Wild Turkey is found also in New South Wales, Queensland, South, and Western Australia.



C. French, Direxit.

Osboldstone & Co., Print

GIANT KINGFISHER OR "LAUGHING JACKASS."

(Dacelo gigas, Leach).

Plate CXXXI.

CHAPTER CXXXVII.

GIANT KINGFISHER OR "LAUGHING JACKASS."

(Dacelo gigas, Leach.)

The so-called Laughing Jackass is so familiar to Australians that a description is hardly necessary. It is well-known as a destroyer of lizards, young snakes, and small birds. It is also partial to chickens, and especially to young turkeys, which it kills by a smart peck on the back of the head.

The Laughing Jackass is also known as a Kingfisher; why, I could never ascertain, as it does not fish, unless it be that it belongs to the same sub-order of birds as the Azure Kingfisher, which is one of the prettiest of our native birds.

The Kookaburra is another name by which this quaint-looking bird is known.

The adult bird, as Mr. Campbell describes, is about 18 inches in length, including tail $5\frac{1}{2}$ inches, and bill 3 inches. It has a dusky back and wings, some part of the wings being relieved with markings of blue; the tail is brownish, and barred with black.

The eggs, which are white, and three to four in a clutch, are usually deposited in the spout of a limb, but more frequently in a hole in the butt of the tree, and not very high, as a rule, from the ground. The young are fluffy little chaps, and make a great noise, which frequently betrays their otherwise secure whereabouts. The eggs are generally not difficult to find, and the egg robber may pursue his calling with safety, whereas had it been, say, a Black-cheeked Falcon, the nest would not have been robbed without a vigorous protest on the part of the birds, both male and female.

Despite the fact of this bird being a terror to the poultry housewife, it is a general favourite, and the farmer, when ploughing, is frequently followed by these birds, which pick up the grubs as the latter are turned out by the plough. They are voracious feeders, and will gorge on grubs until they are hardly able to fly, and in such cases they will hop on to a fence, and, if they are not too much surfeited with food, will usually "laugh" for several moments at a stretch. When perched upon a limb, with a lizard or some other food between its claws, it has a singularly knowing look.

The Giant Kingfisher is a capital mouser, and when in confinement will soon leave but few mice about the place. Sparrows, too, are frequently taken, especially when barely able to fly, the older birds being as a rule too wary for our Kingfisher friend. It is very amusing to see one of these birds, high up on the outstretched branch of a tree, banging a lizard against the limb until the life is knocked out of the unfortunate prey, which is then swallowed whole.

It makes a good pet bird for the garden, and, when not injured and able to get about, even the persistent sparrow gives it a wide berth.

The Giant Kingfisher is found over the whole of Australia.



C. C. Brittlebank, Del.

C. French, Drexel.

WHITE-BACKED MAGPIE OR CROW SHRIKE. (*Gymnorhina leuconota*, Gould.)

Plate CXXXII.

Osboldstone & Co., Print.

CHAPTER CXXXVIII.

WHITE-BACKED MAGPIE OR CROW SHRIKE.

(*Gymnorhina leuconota*, Gould.)

The White-backed Magpie or Crow Shrike is a fearless, aggressive, but easily domesticated bird, and is a great destroyer of underground grubs, locusts, grasshoppers, &c. A very long experience of this bird, and also with the black-backed species, has convinced me that, as a rule, the farmer can well afford to take these fine birds under his special protection. Their grain-eating propensities are well known, and the old-time clapper formerly used for frightening these birds, as well as parrots and sulphur-crested cockatoos, from the crops is still in the memory of the writer.

Both of the magpies are so well known to most that our plate of one of them may be considered sufficient, the economy of both being much alike. It is a singular fact, noticed by many observers, that there would appear to be a line of geographical demarcation between the habits of these two valuable insect-destroying birds. The white-backed species is found mostly south of the Dividing Range, while the black-backed one is found north of these mountains. Both are equally bold, resolute, and aggressive, and, though highly recommended as pets, the writer cannot agree with all that has been stated as to their qualifications in this respect, more especially in cases where young children are concerned. The note of the Magpie is simply delightful, and is one of the many pleasures of country or bush life in Australia.

Gould says, "The white-backed species is more wary and shy in disposition than the black-backed species." This is hardly my experience, but the note in the white-backed species is certainly louder than that of the more

northern form. In many birds it is the male that sings or warbles, but in the case of the Magpie both the sexes give forth their delightful note.

As destroyers of chafer grubs, cutworms, and grasshoppers, the magpies have few equals. During ploughing operations, they may be seen following hard at work at the grubs, which are devoured in enormous quantities.

The nest, which is built of sticks, twigs, &c., and is lined with grass and feathers, is usually located up in a tree, a commanding position being frequently selected. The eggs are usually three or four to a clutch, but sometimes five have been found.

This bird should be protected as far as possible, but when it appears in such numbers as to become a pest to the farmer, a judicious thinning out may be desirable.

The Magpie is found also in New South Wales and South Australia.



L. C. Vald. Andersen, Del.

C. French, Direxit.

Osboldstone & Co., Print.

YELLOW-BREASTED ROBIN.
(*Eopsaltria Australis*, Latham).

Plate CXXXIII.

CHAPTER CXXXIX.

YELLOW-BREASTED ROBIN.

(Eopsaltria Australis, Latham.)

As this beautiful bird is not, strictly speaking, a true robin, it is known to ornithologists as a "Shrike" Robin, but, as all growers know it as the Yellow-breasted Robin, I have adhered to the old name.

The full-grown male is slightly smaller than the one illustrated. The female is much the same in colour, but smaller in size, and, as Gould says, has the rump olive instead of yellow. The nest, of which Mr. Campbell has obtained such an excellent photograph, has been described by him as being cup-shaped and beautiful in form, constructed of fine twigs, but chiefly of bark, with lengthened pieces of outer bark, sometimes 2 or 3 inches long, stuck on perpendicularly outside by means of spiders' web, and further ornamented, especially about the rim, with lichen, lined inside with rootlets and pieces of dead flat sword-like grass, or with whole small dead leaves of eucalyptus. The nest is usually placed low in a fork or on a horizontal branch of a tree in the scrub or a creek or in a forest.

This is one of the greatest favourites among birds; its confiding manner, somewhat slow movements, and cheerful note render its presence welcome at all times. In the dense gullies in the Dandenong and other ranges, its delightful note may be heard before darkness sets in, and even in the Tea-tree (*Leptospermum*) bay fringes it is by no means uncommon.

The Yellow Robin has a marvellous appetite, and there are few birds of its size which destroy so many insects. It is one of the fruit-growers' best friends, and should be

protected. Unfortunately, the slow movements of these birds, and the ease with which their nests are found, render both birds and eggs an easy prey to the egg collector and the small boy alike. It is to be hoped, if only for the sake of the growers, that this bird will be rigorously protected, more especially in the mountainous districts. It holds the palm for general usefulness, and as a destroyer of noxious insects of all kinds.

The Yellow Robin is found also in New South Wales, South Australia, and South Queensland.



C. C. Brittlebank, Del.

C. French, Direxit.

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SOUTHERN STONE PLOVER.

(*Burhinus grallarius*, Latham.)

Plate CXXXIV.

CHAPTER CXL.

SOUTHERN STONE PLOVER.

(*Burhinus grallarius*, Latham.)

The Southern Stone Plover is a very valuable bird, commonly, though erroneously, called the "Curlew," which is, however, a totally different bird. The Curlew has a long, incurved bill, whereas the bill of the Stone Plover, as our plate shows, is quite straight, and much thicker in proportion to the size of the bird.

The natural home of this bird would appear to be in fairly level dry country, but I have also met with them in dry ranges, and, as Mr. Campbell says, "Whether in the forests of Queensland, or in the vast woods of Gippsland, or the drier tracts of the interior provinces of Western Australia, every dweller of the bush is familiar with the weird melancholy calls of the bird at night."

The Stone Plover is remarkable, if only for the prominent eyes and somewhat awkward gait when seen skulking behind some tussocks, evidently trying to divert the attention of the passer-by from its nest; a peculiarity not by any means confined to the bird under notice. The eggs, usually two, are deposited on the bare ground, and are pale-stone or light-buff, blotched all over, sometimes with markings of umber and dull-slate.

According to Mr. Campbell and others, the breeding months include August to December, but I have seen them early in January. Mr. A. J. North says the bird often resorts to the same spot to breed year after year, even though its eggs are repeatedly taken. Mr. Campbell mentions having picked up near Lake Tragowel, Victoria, a pair of eggs just chipped, and by night the young birds

were able to stand and feed themselves. The prevailing colour of the young in down is a light-grey, with a dark marking in the shape of an oval line extending from the head to near the end of the back ; dark lines also extend from the head towards the tail. The young, if alarmed, hide themselves, and lie quite motionless with necks outstretched, rendering their discovery a matter of difficulty.

It would be difficult to speak too highly of this bird as a vermin destroyer, especially in gardens. It has many advantages over the well-known Jamieson's Gull, as it is more voracious and persistent in its search for slugs, &c., and is also more easily reconciled to captivity than even the Sea Gull itself, the latter being always on the alert to try and make its escape. A friend of mine had one of these useful birds for years, and during the whole time the garden was kept wonderfully free from pests of any kind.

Although the Stone Plover is not a very common bird in most parts of Victoria, Mr. Campbell mentions having seen as many as 50 in a flock in the Cardwell district of North Queensland. It is found all over Australia and Tasmania.



L. C. Vald. Andersen, Del.

C. French, Direxit.

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BOOBOOK OWL.

(Ninox boobook, Latham).

Plate CXXXV.

CHAPTER CXLI.

BOOBOOK OWL.

(*Ninox boobook*, Latham.)

This handsome little owl is well known to most of us as the bird which makes the cry of "mopoke," or "morpork," although for years this fact was doubted by many excellent naturalists and others. Formerly, it was believed that the cry of "mopoke" was made by the Common Podargus, or Frogmouth, and Gould has stated as a fact that one of the latter birds kept in captivity did actually make the noise alluded to. My own opinion, and that of others accustomed to the bush, is that both these birds, namely, the Frogmouth and the Boobook, can emit somewhat similar sounds.

The colour of the Boobook Owl is a rusty-brown and white. Gould remarks that the sexes offer but little difference in the colouring of their plumage, but the female is the larger of the two. A great diversity is found to exist in the colouring of the irides, some being yellowish-white, others greenish-yellow, and others brown.

The eggs (three to a sitting) are white and finely pitted, and Mr. Hall gives the measurements as follows:—Length, 1·5 inches; breadth, 1·3 inches. They are deposited in holes in trees. In Mr. Campbell's book, an excellent photograph is given, showing one of our well-known naturalists climbing to a hole in which eggs are supposed to have been deposited.

The Mopoke is one of our most useful insect-destroying birds, especially in the case of night-flying beetles which are so destructive to our forest trees, as they kill and devour them in the most wholesale manner. They also destroy mice and other small vermin.

Although this bird may be regarded as quite nocturnal in its habits, it can fly by day, and I have seen them when, accidentally or otherwise, disturbed fly off to a considerable distance, usually making for some dense foliage in which to hide. Mr. Keartland, well known as a bird observer, mentions having seen one of these owls in the act of devouring a small bird. The Owls will nearly all take birds, and, as is well known, the giant of the family in Australia, namely, the Powerful Owl, has the instinct of a bird of prey, and lives largely upon the common Brush-tailed Opossum, which it tears out of its hole in the trees, and soon makes a meal of it.

Mr. Hall rightly says—"When we consider that there are some 765—[There are a few over this number.—C.F.]—birds in Australia, and only, say, two dozen able to do the night work of checking the ravages of insects or other animals, we should see that a careful preservation of all be strictly enforced." The great ornithologist, Gould, writing of Australian birds, says, "In no other country is there a greater proportion of insectivorous birds than in ours, and certainly none in which nocturnal species as *Podargi* (Frogmouths) are more numerous.

This valuable bird, which is found in Australia and Tasmania, and also, according to Mr. Campbell, on Lord Howe Island, should be carefully protected against all comers.



C. C. Brittlebank, Del.

C. French, Direxit.

Osboldstone & Co., Print.

SPINE-TAILED SWIFT.

(*Chætura caudacuta*, Latham.)

Plate CXXXVI.

CHAPTER CXLII.

SPINE-TAILED SWIFT.

(*Chaetura caudacuta*, Latham.)

The Spine-tailed Swift is a splendid bird, and in size is nearly half as large again as our illustration.

The White-rumped Swift is a bird which is frequently seen in company of the one under notice, but the difference at a distance would hardly be detected by any one but a bird observer.

Unfortunately for us, the Spine-tailed Swift is strictly migratory, reaching here early in November, and staying only till February. Mr. Gould and other observant naturalists inform us that they have never seen one of these birds at rest in Victoria, as they are constantly on the wing, and in search of insects, which they devour in enormous numbers and far beyond ordinary attempts at calculation. They fly with great rapidity, and Gould says that it is possible for a Swift to be hawking for insects on the continent of Australia at one hour, and at the next to be similarly employed across the Bass Straits in Tasmania.

As another illustration of the rapidity of the flight of this remarkable example of the feathered world, Mr. Hall, in his well-known work on insectivorous birds, states that a Swift has never been known to rest on its feet in Victoria, and only a doubtful one in Australia, and he further says the birds build in China, and can breakfast in Asia and dine in Australia on the same day. Not an insect that I know of can escape when once pursued by these birds, as they fly like a flash, and rarely miss the object of their attention.

It is a singular fact that, although this bird is supposed to be known so far back as Pallas, both nest and eggs are, according to Mr. Campbell, as yet undescribed. Mr. Jerdon, the late well-known ornithologist, states that the Spine-tailed Swift breeds amongst the huge wall-like crags of the Himalayas, and Mr. Campbell, in quoting Mr. Allen Owston, of Yokohama, says that it breeds under the Kegon waterfalls near Nikko, Japan, and that the rock under the falls consists of alternate hard and soft layers, making a series of shelves, and the Swifts breed in the recesses between the shelves. The outer edges of these shelves or ledges are so rotten that they will not bear the weight of a man, and therefore the place is practically inaccessible.

Swifts, like the Swallows, are the faithful friends of the rural public at any rate, and should be fully protected.

The Spine-tailed Swift has been found in Australia and Tasmania, also South-eastern Mongolia, Eastern Siberia, China, and Japan, and, according to Mr. Campbell, reported as a straggler twice to Great Britain.



L. C. Vald. Andersen, Del.

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Osboldstone & Co., Print.

REED WARBLER.

(Acrocephalus Australis, Gould).

Plate CXXXVII.

CHAPTER CXLIII.

REED WARBLER.

(*Acrocephalus Australis*, Gould.)

This is a useful and a charming little bird, which has been placed by ornithologists as belonging to the family of true thrushes. The colour is that given on the plate, the bird, however, being somewhat smaller. It is migratory, arriving usually in the early spring. The sexes are alike in general appearance. The nests are usually built in reeds, but sometimes in *Polygonum* or in bulrushes, a twig of *Polygonum* being figured on our plate. The eggs are usually three to four, and are well known, unfortunately, to the egg-hunter.

The Reed Warbler sings both by day and night. I shall always look back with pleasure to a moonlight trip which the celebrated artist, the late Miss North, and myself had to secure this bird's nest and eggs in its natural position for the British Museum. The song is very sustained and melodious, rendering the bird a general favourite.

Mr. Campbell says that on the margins of the Yarra some of the Reed Warblers, on account of the absence of reeds, suspend their nests in the drooping green tresses of willows that hang over the river. As a rule, the Reed Warbler builds over water; but Mr. Campbell remarks that instances are known where nests have been observed on dry land about 50 paces from water in herbage such as flowering stems of dockweed.

This bird has somewhere been alluded to as a seed-eater, but the good which it does far more than compensates for the loss of seed it causes. Its principal food is larvæ, nocturnal moths, and small beetles, also flies and other dipterous insects.

This lovely little bird has a claim, especially on the rural public, not only for its melodious note but for its persistent efforts in destroying insect life.

The Reed Warbler is found also in Queensland, New South Wales, Victoria, South Australia, and Tasmania, and, according to Dr. A. R. Wallace, on the Islands of Lomboek, in the Malayan Archipelago.



C. C. Brittlebank, Del.

C. French, Direxit.

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WHITE-THROATED NIGHTJAR

(*Eurostopus albigularis*, Vigors and Horsfield.)

Plate CXXXVIII.

CHAPTER CXLIV.

WHITE-THROATED NIGHTJAR.

(*Eurostopus albigularis*, Vigors and Horsfield.)

This is a splendid bird, feeding exclusively on insects. The male (see plate) is much like the female, but the latter is somewhat larger, and a trifle lighter in colour.

The egg illustrated is also a little larger than the natural size, and is deposited on the bare ground without a covering of any kind. I once found a very fine specimen of this rare egg near Briagolong, in Gippsland. The egg was out in an open space in lightly-timbered forest country. I am of the opinion that many of the eggs so deposited are destroyed by foxes, iguanas, and snakes, as the birds themselves are not rare.

That celebrated ornithologist, Gould, says, "During my visit to Australia, I had frequent opportunities of observing this species. How far it may range over the Australian continent is not known. I have seen specimens in collections formed at Moreton Bay, Queensland, and I have killed three or four individuals of an evening on the cleared land of the Upper Hunter, which shows that it is far from being a scarce bird in New South Wales. In all probability, it is only a summer visitor to the colonies, for it was at this season that I observed it. In the daytime it sleeps on the ground, or on some dry knoll or open part of the forest, and as twilight approaches sallies forth through the open glades and small plains or cleared lands in search of insects. Its flight, which is much more powerful than that of any other species of the family that I have seen, enables it to pass through the air with great rapidity, and to mount up and dart down almost at right angles, whenever an insect comes within range of its eye, which is so

large and full that its powers of vision must be very great. Most of those obtained were gorged with insects, principally beetles and locusts, some of which were entire and so large as to excite surprise how they could be swallowed ; in several instances they were so perfect that I preserved them as specimens for the cabinet."

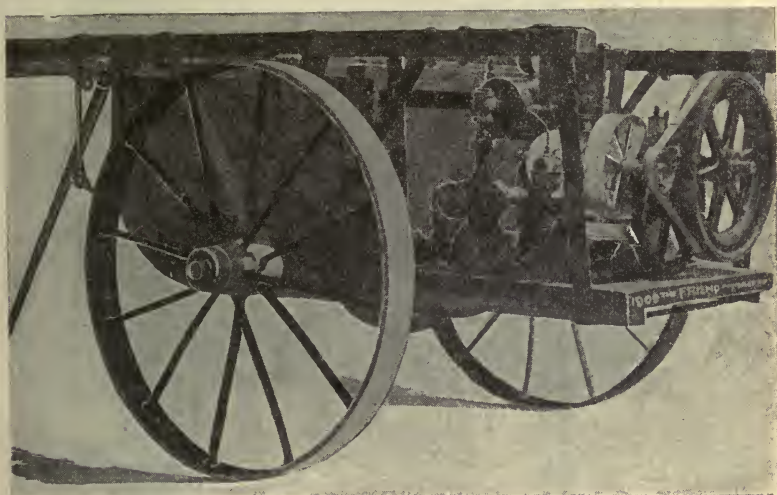
Mr. R. Hall remarks that, judging by the scarcity of the birds in winter time, it is probable that it goes further north to winter, and to get the advantage of a warmer latitude.

The value of this bird to those engaged in forestry can hardly be over-estimated, as the great family of Longicorn beetles, flying as they do by night, fall an easy prey to this and other birds, and of these beetles they must consume enormous quantities. This valuable bird should be most carefully protected. The whole family of the goat-suckers (*Caprimulgidæ*), to which it belongs, are strictly insectivorous in their nature, and worthy of the most strict preservation and protection.

The White-throated Nightjar is found in Victoria, New South Wales, South Australia, Queensland, and Papua.

SPRAYING APPARATUS AND
MATERIALS.

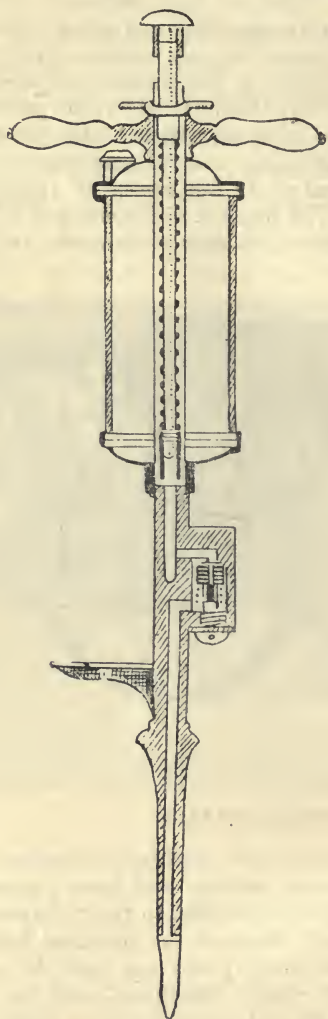
There is little to be added in regard to spraying and spray materials since the publication of Part IV. During the past season, many local brands of arsenate of lead have been placed on the market, and excellent results have been obtained, proving that this mixture can be produced locally at a much lower cost than the imported article. Many of these brands have been tested by the Department, and the particulars of the analyses may be found in the *Journal of the Department of Agriculture* for October and December, 1910. The formula recommended by the Department has been largely in use, as it is easy to prepare, and the cost is slight.



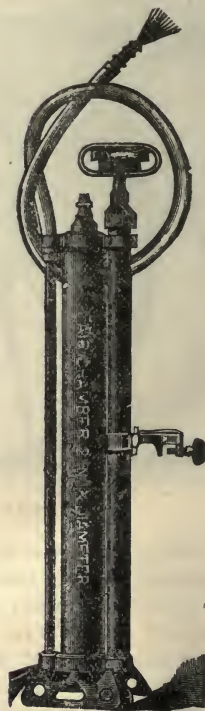
THE "FRIEND" POWER SPRAYER.

During the last couple of years, many of the leading orchardists have discarded the old-fashioned hand spray pumps, and have purchased the up-to-date motor spray pumps, and, according to their statements, excellent results have been obtained. Some of the principal benefits to be derived from using the motor spray pump are that the spray mixture will go further, will be more evenly distributed, and one man can manage the outfit, whereas by the old method two or more men were required to work the hand pumps, and the mixtures were not evenly distributed over the trees; in addition, the wages of the two men were an extra item charged against the upkeep expenses of the orchard. These motor spray pumps are placed on carts or patent trucks, and can be drawn over the rough ground without any trouble.

A new bi-sulphide of carbon injector has been placed on the market, which is a decided improvement on the older injectors, as there is absolutely no leakage, and thus a great saving is effected in the quantity



“ ATTLA ” BISULPHIDE OF
CARBON PATENT INJECTOR.

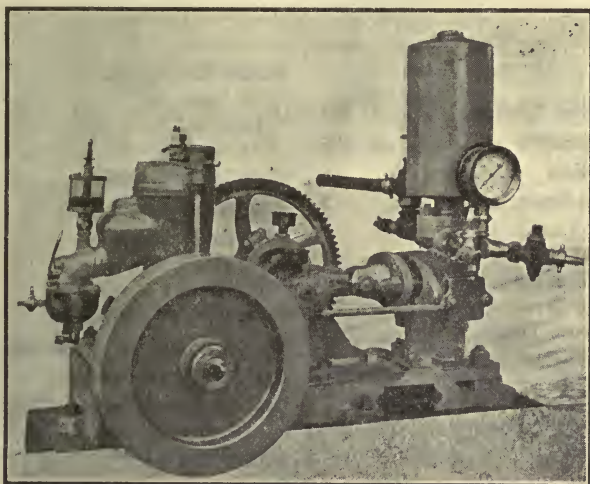


“ BULLDOZER ” SPRAY
PUMP (NO. 2).

of liquid used. The cost of treating phylloxerated vineyards with this injector is greatly lessened, and the work can be done much more rapidly and with greater certainty.

Every season growers are learning more and more the value of spraying, and in many cases as high a percentage as 98 or 99 of clean fruit has been produced in well-sprayed orchards.

Various tobacco mixtures have been tried with good results, the nicotine spray being especially useful in connexion with the Thrips pest in potatoes.



“BAVE-U” POWER SPRAYER.

Benzole emulsion continues to be effectual in dealing with Thrips, and by means of the “Strawsonizer” machine, placed in an ordinary cart and worked by hand, the work can be carried out effectively. Red oil and crude petroleum have given excellent results against Scale insects, Red Spider, and Woolly Aphis.

Lime and sulphur has proved the best spray for Peach Aphis, the spraying, of course, being done while the trees are dormant.

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◆ GEORGE WEST. ◆

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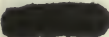
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